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SPIRITUALISM AS A SCIENTIFIC QUESTION.

AN OPEN LETTER TO PROFESSOR HERMANN ULRICI, OF HALLE,

By Professor WILHELM WUNDT,
of the University of Leipsic.

TRANSLATED FROM THE GERMAN BY EDWIN D. MEAD.*

RESPECTED SIR: In the latest number of your "Zeitschrift für Philosophie und philosophische Kritik" I have read a paper from your valued pen, in which you embody a detailed discussion of the spiritualistic phenomena observed here in Leipsic in the presence of the American medium, Mr. Henry Slade. You remark that, according to your conviction, the reality of the facts attested by eminent men of science can no longer be doubted, and that the so-called spiritualism has thus become a scientific question of the highest importance. I should have no occasion to enter upon a discussion of this view of yours, except for the fact that in connection with references to certain of my colleagues in the course of your article, my own name is mentioned in a way which makes it desirable for me to remove every doubt, which you and your readers may have, as to my attitude toward the "scientific question" which you have raised.

You remark that there were present at the *séances* held with Mr. Slade in Leipsic, besides those scientific men who became convinced of the actuality of the spiritualistic phenomena, certain other members

* Translator's Note.—To most regular readers of "The Popular Science Monthly" this letter will be its own sufficient explanation, yet an introductory word may not be superfluous. Spiritualism in Germany, as in England, presents certain phenomena almost precisely opposite to what is seen in America. With us, while the belief has obtained a great popular following, affecting almost all classes of society, becoming a kind of religion as it were, it has not succeeded in making converts of really scientific men, numbering almost no eminent scholars in its ranks—being simply neglected, for the most part, by

of the university, who did not appear to share this conviction. These, among whom you name myself, are of course perfectly free to believe or disbelieve as they please, but it is their duty, as representatives of science, "to state publicly what they saw, and why they doubt the objective reality of what they saw—why they feel compelled to assume jugglery, deceit, or illusion." You add that there remains to these deniers and doubters only the alternative, "either to acknowledge by their silence that there is nothing upon which they are able to base their doubts—therefore, that they simply *will* not believe what is perfectly attested—or to show how it was possible to deceive these men (and many others of unquestionable credibility) in so remarkable a manner."

I feel that I must not neglect so energetic a challenge, and you will permit me not only to make my explanations publicly, according to your wish, but also to address them to yourself. Your article, as I gladly acknowledge, has this advantage over the publications of

whatever properly calls itself science. In England, on the contrary, as is well known, while being no such widespread movement as in America, spiritualism has, during recent years, engaged the earnest attention of prominent scientific circles, has gained many converts of high scientific reputation, and drawn forth the most important contributions to the literature of the subject which exist. The case in Germany is very similar. The principal centers of interest in the subject have been the universities, and, above all, the University of Leipsic, and the principal participants in the investigations and the discussions have been eminent professors. The excitement recently has centered in the *séances* of Mr. Slade, who passed several months in Leipsic and Berlin after his ejection from England, two or three years ago. The result of these *séances* was the conversion or half conversion to spiritualism of several well-known Leipsic professors. Professor I. H. Fichte, now in his eighty-third year, has also recently confessed his faith, pronouncing the Slade phenomena to be "decisive for the cause of spiritualism in Germany." But most surprising of all, perhaps, has been the publication in the last number of the "Zeitschrift für Philosophie und philosophische Kritik," of an article by Professor Ulrici, of Halle, in which he declares his persuasion of the truth of the spiritualistic theory, likewise on the strength of the observations reported by the Leipsic professors—an article the general scope of which is made plain by Professor Wundt's references. To this article Professor Wundt, who has watched the whole movement with critical interest, and who indeed participated in the Slade experiments, deemed it his duty to reply, and he has done so in the form of the letter before us. To scientific men Professor Wundt needs no introduction. He is the principal lecturer in philosophy in the University of Leipsic, and perhaps the most eminent psychologist in Germany, a man of acute thought and well-balanced judgment, distinguished even among German scholars for the breadth and accuracy of his knowledge. It is not too much to say that the reputation and character of no living German thinker could give greater weight to any words on a subject like this. His letter has been immediately recognized in Germany as containing the most reasonable words which have yet been spoken on those phases of the subject to which it confines itself, and it will have a powerful effect in calling back many confused minds to soberness and sense. Professor Wundt believes that scientific men have no longer a right simply to neglect a movement which has become so widespread, which is the occasion of so much perplexity among the people at large, and which is so unquestionably mischievous. It is to be hoped that his words will not fail of their effect in America also, where the intellectual and moral disorders which he declares to be the logical and necessary results of opinions like those discussed are already so apparent and alarming.

similar character, which have heretofore come to my knowledge, that it not only describes certain especially striking instances of the phenomena in question, but also considers the scientific and particularly the philosophical consequences, which must be drawn from the same, as soon as we should determine to acknowledge their reality. I remark that here and in the following pages I use the word reality in the sense which it has in your discussion, excluding from it only the production of the phenomena in a fraudulent manner. For merely subjective phantasms of the observers, these phenomena, as you justly remark, can not be held ; their objectivity and reality in the ordinary sense of the word will in fact be questioned by no man, who may even have read only your short description. I must also agree with your assertion that these facts in and for themselves, their reality presupposed, are of a subordinate importance, compared with the consequences which follow them for our general view of the world. Whether, through conditions unknown to us, tables are occasionally lifted, accordions played, and bed-screens torn, or ghostly hands and feet appear—all this alone is quite indifferent, so long as things of the sort appear in a harmless form, as we may expect from previous observations, a form which clearly gives no fear of deeper disturbance of general natural laws. The more important, on the contrary, would be the philosophical consequences to which the reality of the spiritualistic phenomena would force us. I regard it, therefore, as a real service of your essay, that it not only points out these consequences in general, but that it also seeks to develop, by hints at least, the more particular conceptions which have been suggested to you, concerning the conditions of the phenomena in question, as well as their connection with the general order of the world, and their ethical and religious significance. You have thereby thrown light upon the subject from a side which appears to me more than all others worthy of attention.

I.

Before entering more particularly upon this most original and important part of your essay I am compelled to answer your question concerning my own participation in spiritualistic observations and in regard to the convictions I have gained from them. Permit me, at the same time, by way of preface, a few remarks concerning my attitude toward such phenomena as I have not myself observed, but know only from the statements of others.

You, respected sir, sustain precisely the same relation to all of the so-called "manifestations" which I sustain to a great part of them : your knowledge is based upon the reports of credible witnesses. Therefore you found yourself until recently in the position of a distant, unconcerned spectator. You have chosen to give up this character. You have not only come forward with the greatest energy in favor of the reality of the manifestations, but you also urge others, who would pre-

fer the part of unconcerned spectators, which you now disdain, to publicly confess their belief or unbelief. What impels you to this, as I must call it, remarkable proceeding? The phenomena in question—so you answer—have been observed by scientific men of acknowledged eminence, whose credibility can not be questioned; these men have pronounced them real, therefore their reality is not to be doubted. Your acceptance is, in a word, based upon *authority*. Before I come to the point, permit me two general questions, which I must indeed answer myself, but which I still hope to answer in a way to which you can make no material objection. The first question is, What are the characterizing marks of a scientific authority? The second, What are the limits of the influence upon our own knowledge which we may grant to authority?

What are the characterizing marks of a scientific authority? You, of course, immediately admit that scientific authority is not a property which could be set down in the description of a person. You also agree with me that a person, who passes for authority in some particular science, can not transfer this quality at his pleasure to other provinces. The apocalyptic studies of Isaac Newton were not saved from quick forgetfulness by the authority of the discoverer of gravitation, and the high esteem which Ernst von Baer enjoys as a naturalist scarcely serves as a bill of protection for his Homeric investigations. It is quite true that scientific employment in itself, regardless of the object with which it is concerned, begets that purely theoretical interest in the truth which makes absolute truthfulness of statement in scientific questions a conscientious duty. I should believe, indeed, that only scientific occupation can produce absolute trustworthiness in theoretical questions, because it alone makes a correct estimate of such questions possible. That in this regard the authorities whom you name have, as well on account of their high scientific position as on account of their universally acknowledged personal character, a credibility above every doubt, is a matter of course. But the highest degree of credibility is not sufficient to make any man a scientific authority; there is requisite to this a special professional and in most cases indeed a technical training, which must have approved itself by superior accomplishments in the province concerned. He who has not acquired this professional and technical culture by long years of severe labor is neither capable of achieving anything himself nor of judging the works of others.

You will probably reply to me here that the authorities to whom you appeal are distinguished naturalists, and it is with natural phenomena that the present case has to do. Unhappily, however, I must gainsay you in this; I can not admit that we here have to do with natural phenomena, to whose critical examination naturalists as such, whatever department of natural science they may have been engaged in, are in any way competent. I go still further, indeed, and maintain

that these phenomena are so different from the common province of the naturalist's observations, that they present to him especial difficulties, which plainly exist for others in a less degree.

All the methods of natural science rest upon the presupposition of an unchangeable order of occurrence, which presupposition involves the other, that everywhere, where the same conditions are given, the results must also agree. The naturalist, therefore, proceeds in his observations with unshakable confidence in the positiveness of his objects. Nature can not deceive him; there rules in nature neither freak nor accident. You will admit that we can not speak of a regularity of this sort in the domain of spiritualistic phenomena; on the contrary, the most conspicuous characteristic of these lies precisely in the fact that in their presence the laws of nature seem to be abrogated. But, even considered purely in themselves, they show no trace of an orderly connection or coherence. Even he who may have the hope that such an order will perhaps some day be discovered, can not deny that hitherto all hopes of this sort have been shipwrecked, that spiritualistic observation and natural science stand directly opposed to each other. As little can you deny, on the other hand, that that absolute confidence in the positiveness of the object (truthfulness of the medium) would not be in place in a province where the cardinal question, with which we first of all have to do, is precisely whether the phenomena possess reality or whether they rest upon deception.

Nevertheless I find in the observations which you report tolerably clear indications that the eminent naturalists, who deemed the medium Slade worthy of their investigation, transferred a portion of that confidence, which they justly bring to the ordinary objects of their observation, to this extraordinary object also. You report, for instance, the influences exerted by Mr. Slade upon the movements of a magnetic needle. It appears from your account that the medium was prepared for this experiment, similar experiments having been instituted in Berlin, at the instance of a scientific man there. The phenomena themselves are precisely the same as can be produced by a man provided with a strong magnet. You will not deny that such experiments possess convincing power only for him who is convinced of the correctness of the presupposition of the absolute trustworthiness of the investigated object, i. e., the medium. Now, that the eminent physicists who observed this remarkable phenomenon were chiefly chained by the reversal of the Ampèrian and Weberian molecular currents, which occurred under such unusual influences, is perfectly intelligible; a practical jurist would probably have been not so astonished, but, less accustomed to believe in the trustworthiness of the objects of his investigation, he would scarcely have neglected to examine the coat-sleeves of the medium, with reference to his magnetic powers.

I can not, therefore, respected sir, acknowledge the authorities in

natural science so highly valued by you and by me, as authorities in this province. In order to be able to speak with authority concerning any phenomena, one must possess a thorough critical knowledge of the same. Authorities in the present case, therefore, are only such persons as either possess mediumistic powers or, without claiming to be bearers of such properties, are able to produce phenomena of the same nature. As an authority I would therefore acknowledge Mr. Slade, if he possessed scientific credibility, and also by all means Herr Bellaihini, prestidigitateur in Berlin, who, as is well known, has declared in favor of Mr. Slade, if I could premise in his case that he had a conception of the scientific scope of this question. The only person of whom this is true, and who, at the same time, has successfully imitated many of the Slade experiments, is Dr. Christiani, assistant in the Physiological Institute in Berlin. Dr. Christiani, however, declares his experiments to be mere pieces of jugglery. Now, Herr Christiani is certainly not able to imitate all of Mr. Slade's experiments; but he only professes to be an amateur in a field which Mr. Slade cultivates professionally.

I come to my second question: *What influence may we concede to outside authority upon our own knowledge?* In the immensely preponderant majority of the things which we hold for certain, we all follow the authority of other men; we know only a proportionally small number of facts from our own investigation. Yet all that we owe to foreign authority passes for the more certain the more it agrees with our observation. If a new fact is communicated to us, the investigation of which we are not ourselves in a position to control, then, at least according to the principles hitherto authoritative in science, *two* criteria must be satisfied, if we are to hold the same to be true: First, it must be confirmed by a credible person, who is master of the field concerned; and, secondly, it must not contradict other established facts. Now, you will probably urge here that this second criterion is an exceedingly fluctuating one. Indeed, various spiritualistic authors have not failed to adduce a multitude of instances from the history of science, in which a fact was at first rejected as false or even impossible, and was yet at last proved to be true. But I beg to call your attention to the fact that, in all these instances, the *tertium comparationis* with the case before us consists simply and solely in the fact that something was asserted by some scholars and denied by others. This case still occurs of course repeatedly, and the controversy is always decided in favor of those whose observations stand in contradiction with no other established fact. Usually, indeed, the best passport which a discoverer gives to his new observation consists precisely in his indication of its agreement with other facts. I have looked in vain through the whole history of science for a case in which a scientific authority came forward with the assertion of having discovered a new fact, at the same time adding to this assertion the assurance that

all natural laws were overthrown by the fact, and that in the fact itself no kind of law or order was to be perceived. This case lies before us here. The laws of gravitation, of electricity, of light, and of heat are altogether, as we are assured, of a purely hypothetical validity; they have authority as long as the inexplicable spiritualistic something does not cross them. In this something itself, however, there is to be perceived no sort of law except, at the most, that it is hooked to the heels of certain individuals, the so-called mediums. An authority which asserts this demands more than a scientific authority has ever demanded; it demands that natural Science shall abandon the presupposition of a universal causality, the presupposition upon which all the methods of her investigation rest, and without which an establishment of facts or even of laws of occurrence could never be spoken of.

You will agree with me that this would not be the place to enter upon any long discussion of the origin of the law of causation. You will also probably admit that the most favorable assumption which we could make for spiritualism would be that of its purely empirical origin. Empirical laws can at any time be refuted by other empirical laws. How now, with this premise, is the trustworthiness of a universal causality related to the trustworthiness of the spiritualistic phenomena? On the one side stands the authority of the whole history of science, the totality of all known natural laws, which have not only been discovered under the presupposition of a universal causality, but have also without exception confirmed the same; on the other side stands the authority of a few certainly most eminent naturalists, who, in all which they have discovered in the absence of mediumistic influences, have contributed their part to the confirmation of that most general result of natural investigation, but who now in this *one* point, under a constellation of circumstances which make exact observation difficult in the highest degree, announce the discovery that causality has a flaw and that we must consequently abandon our former view of nature.

I have spoken of the unfavorable constellations under which the spiritualistic phenomena were observed, and, since you might question the warrant of this expression, I must give it a somewhat better basis. I call the constellations unfavorable for observations or experiments, when the observer can not freely manage his senses and his instruments. You would yourself probably call it an unjust demand if a physicist were asked to observe the oscillations of a magnet through a key-hole or an astronomer to take a cellar for his observatory. Yet the observers of spiritualistic phenomena must content themselves with equally unfavorable conditions. The first condition of the success of the experiments is that all persons present shall lay their hands together upon a table and that no observer shall be outside the circle. Thereby a great part of the field of operation is withdrawn from the

observer's view. Mr. Slade, indeed, as the advices state, sometimes seats himself so that his legs are to be seen; but when this shall happen lies at the pleasure of Mr. Slade, not of the observer. So, in general, it is the medium who determines *when* a phenomenon shall appear and *whether* it shall appear. The observers propose experiments, the medium performs them. When a new proposal comes, the spirits answer, "We will try it," and sometimes the attempt succeeds and sometimes not. Occasionally, however, the phenomena desired by the observers are crossed by others entirely unexpected. By this alone the attention is thrown hither and thither in a way most disturbing for exact observations. This, too, occurs equally by reason of purely subjective visions, which the medium appears to have; now there are lights on the ceiling, to which he directs the attention of those present and of which they see nothing; now he falls into sudden convulsions, which must necessarily distract the attention. After all this, I find the expression, also used by yourself, that experiments are made *with* or *upon* Mr. Slade not correct. Rather, Mr. Slade made the experiments; and, if they were made upon any person, then they were made upon those who were present at his manifestations.

If now, respected sir, after a consideration of all the circumstances which are to be gathered from the reports of the *séances* with Mr. Slade, I place myself in that position of an unconcerned distant spectator, which until recently you were so fortunate as to occupy, it would not be to me a matter of question that I should not have written the article which you inserted in the last number of your valuable journal. But, as you had the goodness to remark, I do not find myself in quite that position, and must therefore finally advise you concerning what I saw myself. The state of the case is as follows.

There were present at the *séance*, as you have stated, besides myself, two of my colleagues, Herren Ludwig and Thiersch. We sat with Mr. Slade around a square card-table, one person on each side, our hands laid over each other upon the table. Several writings were produced, in the manner often described, upon a slate, which Mr. Slade held wholly or partially under the table; once a longer writing was obtained between two folded tablets joined by hinges. This double tablet was gradually drawn forward under the edge of the table by Slade *during* the experiment, so that for a short time it was entirely visible; Mr. Slade's hand, however, upon which the tablet rested, was not visible in this. (This, according to my recollection, is the experiment not quite correctly described in one of your notes.) Most of the writings were in English, one in German, but in an incorrect German, such as would be expected from an American or Englishman, who murders the language. Once the experiment with the pocket-knife was performed, quite in the manner you described. Throughout almost the entire *séance*, the door of the room was in violent commotion, such as gusts of wind might create; this explanation,

however, was excluded, since on that afternoon the air was perfectly still. Several times during the *séance* Mr. Slade fell into convulsions and asked me, who sat beside him, whether I felt anything, which, however, was not the case. The other persons present occasionally felt thrusts against their legs, and the tablet, which they held in their hands under the table, was violently pushed away; with myself this did not take place. At the end of the sitting we arose, Mr. Slade laid his hands upon ours and first lifted the table several inches from the floor, then letting it suddenly fall again; it was clearly perceptible that the table was raised by a central force from beneath. With our wish to perform some of the experiments in the presence of an observer standing outside the circle Mr. Slade could not comply. He said that under that condition the spirits did not obey him; he was, moreover, a perfectly passive observer, and must accommodate himself to the conditions which he had accidentally discovered to be favorable for his experiments. Incidentally he gave us intelligence concerning our own mediumistic endowments; me he declared to be a medium "of a strong power." How he came to this knowledge he did not communicate. To myself, as I will not neglect to mention, never in my life has anything appeared or happened which might warrant such a diagnosis.

If you ask me now whether I am in a condition to express a conjecture as to how these experiments were performed, I answer, No. At the same time, however, I must state that phenomena of this sort lie entirely outside the domain of the special training which I have acquired during my scientific career. It is known to every naturalist that one is able to judge an experiment correctly only when one has one's self experimented in a similar direction, and thus has an insight into the conditions of the origin of the phenomena. If I were really a medium "of a strong power," as Mr. Slade asserts, I should perhaps be in a better condition to answer your question; but, since this is not the case, you will certainly find it justifiable, if I do not go into hypotheses as to how the phenomena produced by Mr. Slade were brought about. What was surprising to me in the matter, however, and what will also surprise you, is that Mr. Slade also refused to give any information of this kind. He is a medium, he is an experimenter, and he must therefore know under what conditions the phenomena have their origin. He asserts that he knows nothing of them, but that his relation is a perfectly passive one. The latter, however, is plainly untrue, since the phenomena generally appear only in the *séances* held by him, and also, as a rule, in the order in which he wishes to produce them.

But, although we can not determine *how* Mr. Slade performs his experiments, I agree with you that we still may not in this case pass the field by as one foreign to us. For, as you very justly remark, natural science and philosophy are so actively interested in the ques-

tion concerning the reality or non-reality of the spiritualistic phenomena that we must take some sort of attitude toward it. I confess that, after all I have observed, this question would be for me an extremely painful one if, with you and the eminent men whose authority you follow, I had to regard as excluded every possible explanation of the phenomena in a natural way—in a way which leaves the universal law of causation untouched.

As to the experiments which I saw myself, I believe that they will not fail to produce upon every unprejudiced reader, who has ever seen skillful prestidigitateurs, the impression of well-managed feats of jugglery. You certainly, respected sir, as I think I may conclude from your article, appear scarcely to have accumulated experiences in this direction. This is perfectly intelligible in the case of one whose time has been occupied in earnest studies. But, before you pronounced judgment upon this question with so great precision, it would perhaps have been not altogether out of order, if I may venture to say so, to see and study the performances of a skillful magician. If, indeed, the independent experimental cultivation of this field is closed to us by the direction of our studies, we should still not neglect, before pronouncing a judgment, to become acquainted with phenomena which the most zealous disciples of spiritualism admit to have a close external relation to the spiritualistic manifestations. I can not find that any one of the experiments which I saw with Mr. Slade was above the powers of a good juggler. If the latter has, by means of a place chosen by himself, more extensive apparatus and assistants, more favorable conditions, so, on the other hand, it is not to be denied that Mr. Slade, by reason of the restriction to a smaller number of experiments, the fixing of the participants to a single table, and especially the fact that he does not need to keep to any programme, and that an experiment can occasionally miscarry without damaging his reputation, has advantages on his side. If the "professor of magic" now and then makes use of glitter and parade, in order to distract attention, Mr. Slade attains the same end, in perhaps a still more effectual manner, by means of the subjective fits to which he is exposed.

In my absence certainly much more astonishing performances took place than those which I saw myself. For my judgment of these performances, though other observers were convinced of their trustworthiness, is decisive. One who enters upon observations with this presupposition, will naturally regard as superfluous the precautions which another deems indispensable; he can leave unmentioned some incidental circumstances of the experiment, the knowledge of which would essentially change the estimate of it. This does not involve the slightest reproach against the observer; he acts in his good faith in the trustworthiness of his objects, in a faith which does honor to his feelings, to the same extent that it robs his observations of convincing power. Therefore, respected sir, there remains for me no

other choice in regard to these observations: I prefer the authority of Science to the authority of a few of her representatives, however honorable, who have, in this instance, made observations in a province which lies far from the sphere of their own special studies.

II.

Here I might conclude, passing silently over the hopes which you attach to the reality of the spiritualistic phenomena. But your inferences, philosophical, ethical, and religious, in relation to the subject, appear to me, as I have already observed, so important that they can not be without influence upon our attitude toward the entire question. Permit me, therefore, to betake myself for the moment to your own standpoint. I will assume, as you do, that the reality of the phenomena is no longer to be doubted. What follows from this for our general view of the world, for our judgment of the past and of the future? What effect does it have upon our moral and religious sentiment?

For the purpose of answering these questions, you discuss, in the first place, the hypotheses which we can form concerning the nature of the spiritualistic phenomena. There are three such hypotheses. We can possibly see in the phenomena—1. Expressions of natural forces; 2. Operations of intelligent beings, who belong to a space of *four* dimensions, and who, therefore, possess the power alternately to enter, in their movements, our space of three dimensions, and to vanish from the same into the to us inaccessible fourth dimension; 3. Manifestations of so-called spirits or ghosts. I prefer the latter term, because, according to philosophical usage, we understand by a spirit (*Geist*) an immaterial being, while "the spirits" occasionally undergo materialization, a property which is designated, unambiguously only, by the German word "*Gespenst*" (ghost, apparition). Like all who have engaged themselves with the subject, you reject the first hypothesis, since the phenomena point to arbitrary actions of intelligent beings; only the last two hypotheses, therefore, remain for us to consider.

Here, respected sir, you believe yourself compelled to decide *against* the hypothesis of intelligent beings of *four dimensions* and *for* the hypothesis of ghosts. I will not follow you in your argument, based upon the Kantian theory of knowledge; I would, however, beg to call your attention to the fact that there is no essential difference between the two hypotheses. By a ghost we understand an intelligent being that can suddenly appear in the world of our senses and as suddenly disappear from it again, leaving no traces behind, but we understand precisely the same by an intelligent being of four dimensions. Modern mathematics, as you very well know, has advanced in its speculations astonishingly far, and it has thereby gained the power to define with exactness numerous conceptions, for the designation of which we had

previously to employ common terms of speech. As the modern geometrician speaks of a "plane and in itself congruent manifold of three dimensions," without understanding by it anything else than the space well known to all of us, so he designates with the term "intelligent beings of four dimensions" simply what we ordinary men are accustomed to call ghosts. I believe now with you that the hypothesis which alone is left for us is at the same time the sole hypothesis which would be able to explain the phenomena—their reality being presupposed—and we can therefore confidently make it the basis of our further conclusions. For my own part, I should prefer the term "intelligent beings of four dimensions," because it is more scientific; but for the sake of brevity I will employ the current name of ghosts.

You now put the question—a question worth taking to heart—"Who are these ghosts?" Your deductions lead you to the conclusion that we have to see in them the souls of men who have died, which possess the power to assume again, partially or fully, their former bodily form. Although in Mr. Slade's sittings only detached members—hands and feet—became visible, partly immediately and partly in impressions, it still appears from American advices that materializations of entire bodies are not wanting. I can only assent to this conclusion. I am also essentially determined here by the impression, to which you refer—of a man's foot deformed by a tight shoe—upon a blackened tablet. The assumption that the beings of some other world unknown to us would naturally resemble us not only in their bodily constitution, but also in their dress, has to me only a very slight probability. I confess, indeed, that the thought that hard-hearted shoemakers might even in the next world continue their attempts to improve the anatomical structure of our feet gives me great uneasiness, while I could more easily reconcile myself to the idea that some abiding effects of sufferings here might accompany us into the future. Under this assumption, I count it not altogether impossible that a specialist might be able to conclude from the peculiar character of the deformity as to the period in which the possessor of the foot lived, and perhaps even as to the nation to which he belonged. I regret that this investigation does not appear to have been thought of.

We will assume, therefore, that the ghosts belonged to our deceased fellow men, who advise us in this way of their survival and their condition after death. What significance have the phenomena, then? You, respected sir, believe that you must view this significance as lying above all else in the fact that nothing could more powerfully strengthen our faith in a supreme moral government of the world, nothing more surely counteract the materialism and indifferentism of the time, than the certainty of immortality. To-day, when faith has become tottering, when, at the same time, there are no youthful races (like the Celts, the Teutons, the Slavs) able, as at the time of the decay of ancient civilization, "to take up the broken thread of civiliza-

tion and, upon the ideal loom which Christianity offered, to spin further"—to-day it may please Divine Providence to interfere with the course of nature in *this* way, in order to call back into the thoughts of men their moral nature and end. You acknowledge, indeed, that the written communications of the spirits have a very insignificant content, and that their other performances also seem to be substantially to no purpose; but you console yourself with the thought that the principle of development will also find its application in the other life, so that the souls of the dead only gradually attain the highest perfection of knowledge and will.

Here, unfortunately, I must oppose your conclusions in the most decided manner. I hold these conclusions to be as false as they are dangerous, and of this I will endeavor to convince you and your readers.

In the first place, I beg to call your attention to an unwarranted assumption which is intermingled with your conclusions. You conjecture that Providence, in consideration of the lamentable circumstances and conditions of the present, has felt itself bound to interfere in this peculiar manner. Your conjecture is based upon the assumption that similar phenomena have never been observed in former times. This assumption, however, is false. On the contrary, there has never been a time, so far as I know, when phenomena resembling the spiritualistic phenomena more or less, and in some respects most strikingly, were lacking. To say nothing of the everywhere common appearances of ghosts, I refer you to the facts which occur among numerous peoples and to which the anthropologists give the name of "Shamanism."* The so-called Shamans are manifestly persons with mediumistic properties. They even perform, by means of spirits, who obey their summons, many things which are often astounding, and not seldom resemble, down to the most particular features, the spiritualistic phenomena. I would further call your attention to the fact that, from the fourteenth century on until into the seventeenth, the spiritualistic manifestations, then designated by the terms witchcraft and magic, clearly reached an extent, compared with which their present circulation can be called a declining one. The witches appear, indeed, to have united to a certain extent the properties of the mediums and of the spirits. This, however, in view of the great strength in which the wonderful force was at that time apparently distributed, is quite intelligible. On the other hand, there are often very striking relations; for example, the canceling of the law of gravitation, observed also in recent times, was such an ordinary occurrence that, as is well known, the famous witches' ordeal was based upon it. We even pos-

* The term has primary reference to the superstitions of certain of the Siberian races, but phenomena similar to those observed among these people are met with in many parts of the world, in the Pacific islands, for instance, and among the Indian "medicine-men." —TRANSLATOR.

sess numerous certificates of judges, whose credibility can certainly not be unconditionally denied, according to which a witch sometimes weighed *only half an ounce*, sometimes even nothing at all. You answer that all this belongs to the realm of superstition, and that the pretended facts were never investigated by trustworthy observers. But upon what is this assumption of superstition founded? Simply upon the fact that we have hitherto held the things in question to be impossible. Now you maintain not only the possibility but also the actuality of phenomena equally astonishing, and, moreover, very similar. By all rules of scientific investigation, we are logically bound to assume that those earlier phenomena also may, indeed, in many instances have rested upon deception, but that they were scarcely altogether without foundation. There was of course a lack of exact observers in those days. But do you believe that the Galileian laws of falling bodies were not in force before Galileo demonstrated them by his experiments? There opens up to us from your standpoint an essentially new view of history. Phenomena hitherto regarded as lamentable expressions of a corrupting superstition are transformed into evidences of an especially gracious dissemination of supersensible mysteries.

But I proceed to your real conclusions themselves. The spiritualistic phenomena, silly as they may be in detail, pass with you, by reason of the certainty which they give of another world, as a new source of moral and religious conviction. Our opinion hitherto has been that Providence veiled the future from men with a wise purpose; that its will was to leave the religious nature to form for itself a moral ideal, which should remain untouched by the imperfections of the world of sense. This condition of things is by your view essentially changed. Our future destiny is no longer a subject of moral demands and religious convictions, but, to a certain extent at least, belongs to our knowledge and perception. You do indeed lay stress upon the fact that precisely that phase of the other world which we perceive may be the less perfect phase. That might pass, if at least the beginning of a process of perfection were apparent to us. But I see only the shocking contrary of this. What conception must we form of the condition of our deceased fellow men, if your view is correct? I find myself forced to the following conclusions, against which, so far as I can see, you can urge no material objections:

1. *Physically* the souls of our dead fall into the bondage of certain living men, the so-called mediums. These mediums are, at present at any rate, not very widely spread, and appear to belong almost exclusively to the American nationality. At the command of the mediums, the souls execute mechanical performances, which bear throughout the character of purposelessness: they knock, lift tables and chairs, play harmoniums, etc.

2. *Intellectually* the souls fall into a condition which, so far as

we can conclude from the character of their writings upon slates, can only be described as lamentable. These writings belong throughout to the domain of higher or lower stupidity, chiefly lower—i. e., they are absolutely without sense.

3. The *moral* condition of the souls seems to be relatively the most favorable. According to all the evidence, the character of harmlessness can not be denied them. It shows itself particularly in the fact that they hold it to be necessary to make excuses for proceedings of a somewhat brutal nature, in case of becoming guilty of such—as, for instance, the destruction of a bed-screen, with a politeness which, in a ghost, is certainly deserving of acknowledgment. This harmlessness, therefore, gives us a right to expect something good of their other moral qualities, concerning which nothing particular is known.

Pardon me if I seem to joke. You would misunderstand me if you should believe that I had adduced these consequences of your premises with any other intention than that of indicating as forcibly as possible the earnest scientific, moral, and religious anxiety which the views that you represent in your latest essay must necessarily awaken.

I will not speak of how, even in the most favorable case of your example finding no further following, the science which concerns us both most nearly, philosophy, can not be without danger of having its reputation severely damaged, when one of its distinguished representatives, who has treated almost all of its departments and has especially occupied himself earnestly with logical studies, now suddenly throws overboard all principles of scientific investigation, in order to find in the revelations of rapping spirits the means of supplementing our insight into the order of the world. The specialist in scientific investigation has the prerogative of a certain one-sidedness; we justify many a freak in his narrower field which can not abide the test of criticism. But what is to become of philosophy, if it abandons the general principles of knowledge, whose authority it is its office to establish for the special sciences? Yet even this particular interest is of subordinate importance, compared with the serious consequences which your procedure must have, if, which God forbid, it should find more followers in the scientific world. Whence is the scientific investigator to get courage and perseverance for his work, if the laws of nature, according to the prospect which you open, are approaching a point where they shall be done away with? And who will still be inclined to occupy himself with scientific problems, when he is allured by the hope of obtaining an answer to the deepest and highest questions by means of spiritualistic appearances? It is true that the disclosures already won in this way are good for nothing. But how were it possible for individuals and societies to spend their time in these idle occupations, if they did not hope for better results? A mournful intellectual desolation would be the necessary consequence, if views such as you pro-

claim to-day should ever become the common property of the scientific world.

This might pass, however, if that moral and religious awakening which you hope from the spiritualistic manifestations were really to be expected from them, according to the teachings of history and the laws of human nature. I almost hesitate to say to you that the moral deepening of religion has continually kept pace with the doing away of rude representations of the divine in forms of sense, and that, alongside weak-minded unbelief, the worst enemy of morality has always been superstition.

These are things long well known to you. You indeed declare the phenomena to which you refer to be realities, and therefore different from the objects of superstition. But every superstition has done that. Not upon *whether* one believes in certain phenomena or not, but only upon the *objects* in which one believes, can the corrupting effects of superstition depend. The moral barbarism produced in its time by the belief in witchcraft would have been precisely the same, if there had been real witches. We can therefore leave the question entirely alone, whether or not you have ground to believe in the spiritualistic phenomena. We can content ourselves with considering the question, whether the objects of your belief show the characteristic signs which we find in those objects of belief which, according to the testimony of history and of social psychology, we must call prejudicial to the moral development of man. This question, after the intimate relation which we have shown to exist between spiritualism and the most corrupt forms of so-called superstition, can only be answered in the affirmative. The reasons for this demoralizing influence, as you as a psychologist will easily perceive, are also perfectly apparent. The danger of estrangement from earnest work, devoted to the service of science or of a practical calling, which I have already touched, is to be included here, if indeed in a subordinate place. Of far greater importance are the unworthy conceptions of the condition of the spirit after death, which these phenomena awaken, and which find their analogy only in the so-called animism of the most degraded races. But most pernicious of all appears to me the caricature which the spiritualistic system, in the form in which you represent it, makes of the rule of a higher order of the world, by making men of, at the very least, most ordinary intellectual and spiritual endowments the bearers of supernatural powers, thereby sealing them as the chosen instruments of Providence. In all these features, and above all in the materialization of the ghosts, there is betrayed a grossly materialistic tendency, of which, as I am glad to believe, most of the German spiritualists are not conscious. They are only the pitiable victims of exotic Shamans, who have transplanted to Europe the animistic conceptions which have not entirely disappeared in their home. From a philosopher this materialistic character of spiritualism ought not to have remained

concealed. Astonishingly, however, you see in it nothing less than a contrivance of Providence for counteracting the materialism of the present. This is to me the most incomprehensible part of your essay. I see in spiritualism, on the contrary, a sign of the materialism and the barbarism of our time. From early times, as you well know, materialism has had two forms; the one denies the spiritual, the other transforms it into matter. The latter form is the older. From the animism of the popular mythologies, it passes into philosophy, in order to be by the latter gradually overcome. As civilized barbarism can experience relapses into all forms of primitive conditions, so it is not spared from this also.

That, in your person, philosophy too has shared in this relapse, I count most melancholy. Above all else, however, I deplore the possible influence of your example upon our academical youth, among whose instructors you belong. What would become of science, if pursuits which your views only too easily encourage should become prevalent among our students; if earnest work and the emulation of scientific studies should become supplanted among them by an aimless chase after wonders and by rapping-spirit clubs? I have such firm confidence in the sound sense of our youth, that I am sure these fears will not be realized. Nevertheless, I held it to be my duty no longer to remain a silent spectator, but to answer your challenge. I sincerely hope, at the same time, that my answer may succeed in prompting you to another careful consideration of the subject. Then perhaps I may not entirely relinquish the hope that we may one day find ourselves with a common feeling concerning this question.

With this wish, I remain, with high esteem, yours,

W. WUNDT.

GEOGRAPHICAL EVOLUTION.

BY PROFESSOR ARCHIBALD GEIKIE, F. R. S.

II.

THE ARCHITECTURE OF THE LAND.—Let us now proceed to consider how these materials, sedimentary and crystalline, have been put together, so as to constitute the solid land of the globe.

It requires but a cursory examination to observe that the sedimentary masses have not been huddled together at random; that, on the contrary, they have been laid down in sheets one over the other. An arrangement of this kind at once betokens a chronological sequence. The rocks can not all have been formed simultaneously. Those at the bottom must have been laid down before those at the top. A truism of this kind seems hardly to require formal statement. Yet it lies at

the very foundation of any attempt to trace the geological history of a country. Did the rocks everywhere lie undisturbed one above another as they were originally laid down, their clear order of succession would carry with it its own evident interpretation. But such have been the changes that have arisen, partly from the operation of forces from below, partly from that of forces acting on the surface, that the true order of a series of rocks is not always so easily determined. By starting, however, from where the succession is normal and unbroken, the geologist can advance with confidence into regions where it has been completely interrupted—where the rocks have been shattered, crumpled, and even inverted.

The clew which guides us through these labyrinths is a very simple one. It is afforded by the remains of once living plants and animals which have been preserved in the rocky framework of the land. Each well-marked series of sedimentary accumulations contains its own characteristic plants, corals, crustaceans, shells, fishes, or other organic remains. By these it can be identified and traced from country to country across a whole continent. When, therefore, the true order of superposition of the rocks has been ascertained by observing how they lie upon each other, the succession of their fossils is at the same time fixed. In this way the sedimentary part of the earth's crust has been classified into different formations, each characterized by its distinct assemblage of organic remains. In the most recent formations, most of these remains are identical with still living species of plants and animals ; but as we descend in the series and come into progressively older deposits, the proportion of existing species diminishes until at last all the species of fossils are found to be extinct. Still older and lower rocks reveal types and assemblages of organisms which depart further and further from the existing order.

By noting the fossil contents of a formation, therefore, even in a district where the rocks have been so disturbed that their sequence is otherwise untraceable, the geologist can confidently assign their relative position to each of the fractured masses. He knows, for instance (using for our present purpose the letters of the alphabet to denote the sequence of the formations), that a mass of limestone containing fossils typical of the formation B must be younger than another mass of rock containing the fossils of A. A series of strata full of the fossils of H resting immediately on others charged with those of C, must evidently be separated from these by a great gap, elsewhere filled in by the intervening formations D, E, F, G. Nay, should the rocks in the upper part of a mountain be replete with the fossils proper to D, while those in the lower slopes showed only the fossils of E, F, and G, it could be demonstrated that the materials of the mountain had actually been turned upside down, for, as proved by its organic remains, the oldest and therefore lowest formation had come to lie at the top, and the youngest, and therefore highest, at the bottom.

Of absolute chronology in such questions science can as yet give no measure. How many millions of years each formation may have required for its production, and how far back in time may be the era of any given group of fossils, are problems to which no answer, other than a mere guess, can be returned. But this is a matter of far less moment than the relative chronology, which can usually be accurately fixed for each country, and on which all attempts to trace back the history of the land must be based.

While, then, it is true that most of the materials of the solid land have been laid down at successive periods under the sea, and that the relative dates of their deposition can be determined, it is no less certain that the formation of these materials has not proceeded uninterruptedly, and that they have not finally been raised into land by a single movement. The mere fact that they are of marine origin shows, of course, that the land owes its origin to some kind of terrestrial disturbance. But, when the sedimentary formations are examined in detail, they present a most wonderful chronicle of long-continued, oft-repeated, and exceedingly complex movements of the crust of the globe. They show that the history of every country has been long and eventful ; that, in short, hardly any portion of the land has reached its present condition, save after a protracted series of geological revolutions.

One of the most obvious and not the least striking features in the architecture of the land is the frequency with which the rocks, though originally horizontal, or approximately so, have been tilted up at various angles, or even placed on end. At first it might be supposed that these disturbed positions have been assumed at random, according to the capricious operations of subterranean forces. They seem to follow no order, and to defy any attempt to reduce them to system. Yet a closer scrutiny serves to establish a real connection among them. They are found, for the most part, to belong to great though fractured curves, into which the crust of the earth has been folded. In low countries far removed from any great mountain-range, the rocks often present scarcely a trace of disturbance, or, if they have been affected, it is chiefly by having been thrown into gentle undulations. As we approach the higher grounds, however, they manifest increasing signs of commotion. Their undulations become more frequent and steeper, until, entering within the mountain-region, we find the rocks curved, crumpled, fractured, inverted, tossed over each other into yawning gulf and towering crest, like billows arrested at the height of a furious storm.

Yet even in the midst of such apparent chaos it is not impossible to trace the fundamental law and order by which it is underlaid. The prime fact to be noted is the universal plication and crumpling of rocks which were at first nearly horizontal. From the gentle undulations of the strata beneath the plains to their violent contortion and inversion among the mountains, there is that insensible gradation which connects

the whole of these disturbances as parts of one common process. They can not be accounted for by any mere local movements, though such movements no doubt took place abundantly. The existence of a mountain-chain is not to be explained by a special upheaval or series of upheavals caused by an expansive force acting from below. Manifestly the elevation is only one phase of a vast terrestrial movement which has extended over whole continents, and has affected plains as well as high grounds.

The only cause which, so far as our present knowledge goes, could have produced such wide-spread changes is a general contraction of the earth's mass. There can be no doubt that at one time our planet existed in a gaseous, then in a liquid condition. Since these early periods it has continued to lose heat, and consequently to contract and to grow more and more solid, until, as the physicists insist, it has now become practically as rigid as a globe of glass or of steel. But in the course of the contraction, after the solid external crust was formed, the inner hot nucleus has lost heat more rapidly than the crust, and has tended to shrink inward from it. As a consequence of this internal movement, the outer solid shell has been obliged to sink down upon the retreating nucleus. In so doing, it has of course had to accommodate itself to a diminished area, and this it could only accomplish by undergoing plication and crumpling. Though the analogy is not a very exact one, we may liken our globe to a shriveled apple. The skin of the apple does not contract equally. As the internal moisture passes off, and the bulk of the fruit is reduced, the once smooth exterior becomes here and there corrugated and dimpled.

Without entering into this difficult problem in physical geology, it may suffice if we carry with us the idea that our globe must once have had a greater diameter than it now possesses, and that the crumpling of its outer layers, whether due to mere contraction or, as has been suggested, to the escape also of subterranean vapors, affords evidence of this diminution. A little reflection suffices to show us that, even without any knowledge of the actual history of the contraction, we might anticipate that the effects would neither be continuous nor everywhere uniform. The solid crust would not, we may be sure, subside as fast as the mass inside. It would, for a time at least, cohere and support itself, until at last, gravitation proving too much for its strength, it would sink down. And the areas and amount of descent would be greatly regulated by the varying thickness and structure of the crust. Subsidence would not take place everywhere; for, as a consequence of the narrower space into which the crust sank, some regions would necessarily be pushed up. These conditions appear to have been fulfilled in the past history of the earth. There is evidence that the terrestrial disturbance has been renewed again and again, after long pauses, and that, while the ocean-basins have on the whole been the great areas of depression, the continents have been the lines

of uprise or relief, where the rocks were crumpled and pushed out of the way. Paradoxical, therefore, as the statement may appear, it is nevertheless strictly true that the solid land, considered with reference to the earth's surface as a whole, is the consequence of subsidence rather than of upheaval.

Grasping, then, this conception of the real character of the movements to which the earth owes its present surface configuration, we are furnished with fresh light for exploring the ancient history and growth of the solid land. The great continental ridges seem to lie nearly on the site of the earliest lines of relief from the strain of contraction. They were forced up between the subsiding oceanic basins at a very early period of geological history. In each succeeding epoch of movement they were naturally used over again, and received an additional push upward. Hence we see the meaning of the evidence supplied by the sedimentary rocks as to shallow seas and proximity of land. These rocks could not have been otherwise produced. They were derived from the waste of the land, and were deposited near the land. For it must be borne in mind that every mass of land, as soon as it appeared above water, was at once attacked by the ceaseless erosion of moving water and atmospheric influences, and immediately began to furnish materials for the construction of future lands, to be afterward raised out of the sea.

Each great period of contraction elevated anew the much-worn land, and, at the same time, brought the consolidated marine sediments above water as parts of a new terrestrial surface. Again a long interval would ensue, marked perhaps by a slow subsidence both of the land and sea-bottom. Meanwhile the surface of the land was channeled and lowered, and its detritus was spread over the sea-floor, until another era of disturbance raised it once more with a portion of the surrounding ocean-bed. These successive upward and downward movements explain why the sedimentary formations do not occur as a continuous series, but often lie each upon the upturned and worn edge of its predecessors.

Returning now to the chronological sequence indicated by the organic remains preserved among the sedimentary rocks, we see how it may be possible to determine the relative order of the successive upheavals of a continent. If, for example, a group of rocks, which, as before, may be called A, were found to have been upturned and covered over by undisturbed beds C, the disturbance could be affirmed to have occurred at some part of the epoch represented elsewhere by the missing series B. If, again, the group C were observed to have been subsequently tilted, and to pass under gently-inclined or horizontal strata E, a second period of disturbance would be proved to have occurred between the time of C and E.

I have referred to the unceasing destruction of its surface which the land undergoes from the time when it emerges out of the sea. As

a rule, our conceptions of the rate of this degradation are exceedingly vague. Yet they may easily be made more definite by a consideration of present changes on the surface of the land. Every river carries yearly to the sea an immense amount of sand and mud. But this amount is capable of measurement. It represents, of course, the extent to which the general level of the surface of the river's drainage-basin is annually lowered. According to such measurements and computations as have been already made, it appears that somewhere about $\frac{1}{6000}$ of a foot is every year removed from the surface of its drainage-basin by a large river. This seems a small fraction, yet by the power of mere addition it soon mounts up to a large total. Taking the mean level of Europe to be 600 feet, its surface, if everywhere worn away at what seems to be the present mean normal rate, would be entirely reduced to the sea-level in little more than three and a half millions of years.

But of course the waste is not uniform over the whole surface. It is greatest on the slopes and valleys, least on the more level grounds. A few years ago, in making some of the estimates of the ratios between the rates of waste on these areas, I assumed that the tracts of more rapid erosion occupy only one ninth of the whole surface affected, and that in these the rate of destruction is nine times greater than on the more level spaces. Taking these proportions, and granting that $\frac{1}{6000}$ of a foot is the actual ascertained amount of loss from the whole surface, we ascertain by a simple arithmetical process that $\frac{1}{12}$ of an inch is carried away from the plains and table-lands in seventy-five years, while the same amount is worn out of the valleys in eight and a half years. One foot must be removed from the former in 10,800 years, and from the latter in 1,200 years. Hence we learn that at the present rate of erosion a valley 1,000 feet deep may be excavated in 1,200,000 years —by no means a very long period in the conceptions of most geologists.

I do not offer these figures as more than tentative results. They are based, however, not on mere guesses, but on data which, though they may be corrected by subsequent inquiry, are the best at present available, and are probably not far from the truth. They are of value in enabling us more vividly to realize how the prodigious waste of the land, proved by the existence of such enormous masses of sedimentary rock, went quietly on age after age, until results were achieved which seem at first scarcely possible to so slow and gentle an agency.

It is during this quiet process of decay and removal that all the distinctive minor features of the land are wrought out. When first elevated from the sea, the land doubtless presents on the whole a featureless surface. It may be likened to a block of marble raised out of the quarry—rough and rude in outline, massive in solidity and strength, but giving no indication of the grace into which it will grow under the hand of the sculptor. What art effects upon the marble block, Nature accomplishes upon the surface of the land. Her tools are many and

varied—air, frost, rain, springs, torrents, rivers, avalanches, glaciers, and the sea—each producing its own characteristic traces in the sculpture. With these implements, out of the huge bulk of the land she cuts the valleys and ravines, scoops the lake-basins, hews with bold, free hand the colossal outline of the mountains, carves out peak and crag, crest and cliff, chisels the courses of the torrents, splinters the sides of the precipices, and leaves her impress upon every lineament of the land. Patiently and unceasingly has this great earth-sculptor sat at her task since the land first rose above the sea, washing down into the ocean the *débris* of her labor, to form the materials for the framework of future countries; and there will she remain at work, so long as mountains stand, and rain falls, and rivers flow.

THE GROWTH OF THE EUROPEAN CONTINENT.—Passing now from the general principles with which we have hitherto been dealing, we may seek an illustration of their application to the actual history of a large mass of land. For this purpose, let me ask your attention to some of the more salient features in the gradual growth of Europe. This continent has not the simplicity of structure elsewhere recognizable; but, without entering into detail or following a continuous sequence of events, our present purpose will be served by a few broad outlines of the condition of the European area at successive geological periods.

It is the fate of continents, no less than of the human communities that inhabit them, to have their first origin shrouded in obscurity. When the curtain of darkness begins to rise from our primeval Europe, it reveals to us a scene marvelously unlike that of the existing continent. The land then lay chiefly to the north and northwest, probably extending as far as the edge of the great submarine plateau by which the European ridge is prolonged under the Atlantic for 230 miles to the west of Ireland. Worn fragments of that land exist in Finland, Scandinavia, and the northwest of Scotland, and there are traces of what seem to have been some detached islands in Central Europe, notably in Bohemia and Bavaria. Its original height and extent can of course never be known; but some idea of them may be formed by considering the bulk of solid rock which was formed out of the waste of that land. I find that if we take merely one portion of the detritus washed from its surface and laid down in the sea, viz., that which is comprised in what is termed the Silurian system, and if we assume that it spreads over 60,000 square miles of Britain with an average thickness of 16,000 feet, or three miles, which is probably under the truth, then we obtain the enormous mass of 180,000 cubic miles. The magnitude of this pile of material may be better realized if we reflect that it would form a mountain-ridge three times as long as the Alps, or from the North Cape to Marseilles (1,800 miles), with a breadth of more than thirty-three miles, and an average height of 16,000 feet, that is, higher than the summit of Mont Blanc. All this vast pile of sedimentary rock was worn from the slopes and shores of the primeval northern land. Yet it represents but

a small fraction of the material so removed, for the sea of that ancient time spread over nearly the whole of Europe eastward into Asia, and everywhere received a tribute of sand and mud from the adjoining shores.

There is perhaps no mass of rock so striking in its general aspect as that of which this northern embryo of Europe consisted. It lacks the variety of composition, structure, color, and form, which distinguishes rocks of more modern growth. But in dignity of massive strength it stands altogether unrivaled. From the headlands of the Hebrides to the far fiords of Arctic Norway it rises up grim and defiant of the elements. Its veins of quartz, feldspar, and hornblende project from every boss and crag like the twisted and knotted sinews of a magnificent torso. Well does the old gneiss of the north deserve to have been made the foundation-stone of a continent.

Whether vegetation clothed this earliest prototype of Europe, and, if so, what were its characters, are questions to which at present no answer is possible. We know, however, that the shallow sea which spread from the Atlantic southward and eastward over most of Europe was tenanted by an abundant and characteristic series of invertebrate animals—trilobites, graptolites, cystideans, brachiopods, and cephalopods, strangely unlike on the whole to anything living in our waters now, but which then migrated freely along the shores of the Arctic land between what are now America and Europe.

The floor of this shallow sea continued to sink until over Britain at least it had gone down several miles. Yet the water remained shallow because the amount of sediment constantly poured into it from the northwest filled it up about as fast as the bottom subsided. This slow subterranean movement was varied by uprisings here and there, notably by the outburst at successive periods of a great group of active submarine volcanoes over Wales, the Lake District, and the south of Ireland. But at the close of the Silurian period a vast series of disturbances took place, as the consequence of which the first rough outlines of the European Continent were blocked out. The floor of the sea was raised into long ridges of land, among which were some on the site of the Alps, the Spanish Peninsula, and the hills of the west and north of Britain. The thick mass of marine sediment was crumpled up, and here and there even converted into hard crystalline rock. Large inclosed basins, gradually cut off from the sea, like the modern Caspian and the Sea of Aral, extended from beyond the west of Ireland across to Scandinavia and even into the west of Russia. These lakes abounded in bone-covered fishes of strange and now long-extinct types, while the land around was clothed with a club-moss and reed-like vegetation—*Psilophyton*, *Sigillaria*, *Calamite*, etc.—the oldest terrestrial flora yet known in Europe. The sea, dotted with numerous islands, appears to have covered most of the heart of the continent.

A curious fact deserves to be noticed here. During the convulsions by which the sediments of the Silurian sea-floor were crumpled up, crystallized, and elevated into land, the area of Russia seems to have remained nearly unaffected. Not only so, but the same immunity from violent disturbance has prevailed over that vast territory during all subsequent geological periods. The Ural Mountains on the east have again and again served as lines of relief, and have been from time to time ridged up anew. The German domains on the west have likewise suffered extreme convulsion. But the wide intervening plateau of Russia has apparently always maintained its flatness either as sea-bottom or as terrestrial plains.

By the time of the coal-growths, the aspect of the European area had still further changed. It then consisted of a series of low ridges or islands in the midst of a shallow sea or of wide salt-water lagoons. A group of islands occupied the site of some of the existing high grounds of Britain. A long, irregular ridge ran across what is now France from Brittany to the Mediterranean. The Spanish Peninsula stood as a detached island. The future Alps rose as a long, low ridge, to the north of the eastern edge of which lay another insular space, where now we find the high grounds of Bavaria and Bohemia. The shallow waters which wound among these scattered patches of land were gradually silted up. Many of them became marshes, crowded with a most luxuriant cryptogamic vegetation, specially of lycopods and ferns, while the dry grounds waved green with coniferous trees. By a slow intermittent subsidence, islet after islet sank beneath the verdant swamps. Each fresh depression submerged the rank jungles and buried them under sand and mud, where they were eventually compressed into coal. To this united coöperation of dense vegetable growth, accumulation of sediment, and slow subterranean movement, Europe owes her coal-fields.

All this time the chief area of high ground in Europe appears still to have lain to the north and northwest. The old gnarled gneiss of that region, though constantly worn down and furnishing materials toward each new formation, yet rose up as land. It no doubt received successive elevations, during the periods of disturbance, which more or less compensated for the constant loss from its surface.

The next scene we may contemplate brings before us a series of salt lakes, covering the center of the continent from the north of Ireland to the heart of Poland. These basins were formed by the gradual cutting off of portions of the sea which had spread over the region. Their waters were red and bitter, and singularly unfavorable to life. On the low intervening ridges a coniferous and cycadaceous vegetation grew, sometimes in quantity sufficient to supply materials for the formation of coal-seams. The largest of these salt lakes stretched from the edge of the old plateau of Central France along the base of the Alpine ridge to the high grounds of Bohemia, and included the

basin of the Rhine from Basel down to the ridge beyond Mayence, which has been subsequently cut through by the river into the picturesque gorges between Bingen and the Siebengebirge. This lake was filled up with red sand and mud, limestone, and beds of rock-salt. Where the eastern Alps now rise, the inclosed water-basins were the scene of a long-continued growth of dolomite, out of which in later ages the famous dolomite mountains of the Tyrol were carved.

These salt lakes of the Triassic period seem to have been everywhere quietly effaced by a wide-spread depression, which allowed the water of the main ocean once more to overspread the greater part of Europe. This slow subsidence went on so long as to admit of the accumulation of masses of limestone, shale, and sandstone, several thousand feet in thickness, and probably to bring most of the insular tracts of Central Europe under water. To this period, termed by geologists the Jurassic, we can trace back the origin of a large part of the rock now forming the surface of the continent, from the low plains of Central England up to the crests of the northern Alps, while in the Mediterranean basin, rocks of the same age cover a large area of the plateau of Spain, and form the central mass of the chain of the Apennines. It is interesting to know that the northwest of Britain continued still to rise as land in spite of all the geographical changes which had taken place to the south and east. We can trace even yet the shores of the Jurassic sea along the skirts of the mountains of Skye and Ross-shire.

The next long era, termed the Cretaceous, was likewise more remarkable for slow accumulation of rock under the sea than for the formation of new land. During that time the Atlantic sent its waters across the whole of Europe and into Asia. But they were probably nowhere more than a few hundred feet deep over the site of our continent, even at their deepest part. Upon their bottom there gathered a vast mass of calcareous mud, composed in great part of foraminifera, corals, echinoderms, and mollusks. Our English chalk which ranges across the north of France, Belgium, Denmark, and the north of Germany, represents a portion of the deposits of that sea-floor. Some of the island spaces which had remained for a vast period above water, and had by their degradation supplied materials for the sediment of successive geological formations, now went down beneath the Cretaceous sea. The ancient high-grounds of Bohemia, the Alps, the Pyrenees, and the Spanish table-land, were either entirely submerged, or at least had their area very considerably reduced. The submergence likewise affected the northwest of Britain; the western Highlands of Scotland lay more than one thousand feet below their present level.

When we turn to the succeeding geological period, that of the Eocene, the proofs of wide-spread submergence are still more striking. A large part of the Old World seems to have sunk down; for we find that one wide stretch of sea extended across the whole of Central

Europe and Asia. It was at the close of this period of extreme depression that those subterranean movements began to which the present configuration of Europe is mainly due. The Pyrenees, Alps, Apennines, Carpathians, the Caucasus, and the heights of Asia Minor mark as it were the crests of the vast earth-waves into which the solid framework of Europe was then thrown. So enormous was the contortion that, as may be seen along the northern Alps, the rocks for thousands of feet were completely inverted, this inversion being accompanied by the most colossal folding and twisting. The massive sedimentary formations were crumpled up, and doubled over each other, as we might fold a pile of cloth. In the midst of these commotions the west of Europe remained undisturbed. It is strange to reflect that the soft clays and sands under London are as old as some of the hardened rocks which have been upheaved into such picturesque peaks along the northern flanks of the Alps.

After the completion of these vast terrestrial disturbances, the outlines of Europe began distinctly to shape themselves into their present form. The Alps rose as a great mountain-range, flanked on the north by a vast lake which covered all the present lowlands of Switzerland, and stretched northward across a part of the Jura Mountains, and eastward into Germany. The size of this fresh-water basin may be inferred from the fact that one portion only of the sand and gravel that accumulated in it even now measures six thousand feet in thickness. The surrounding land was densely clothed with a vegetation indicative of a much warmer climate than Europe now can boast. Palms of American types, as well as date-palms, huge Californian pines (Sequoia), laurels, cypresses, and evergreen oaks, with many other evergreen trees, gave a distinctive character to the vegetation. Among the trees too were planes, poplars, maples, willows, oaks, and other ancestors of our living woods and forests; numerous ferns grew in the underwood, while clematis and vine wound themselves among the branches. The waters were haunted by huge pachyderms, such as the dinotherium and hippopotamus; while the rhinoceros and mastodon roamed through the woodlands.

A marked feature of this period in Europe was the abundance and activity of the volcanoes. In Hungary, Rhineland, and Central France, numerous vents opened and poured out their streams of lava and showers of ashes. From the south of Antrim, also, another great line of active orifices ran up the west coast of Scotland and by the Faroe Islands to Iceland, whence it extended even far into Arctic Greenland.

The mild climate indicated by the vegetation in the deposits of the Swiss lake, prevailed even into polar latitudes, for the remains of numerous evergreen shrubs, oaks, maples, walnuts, hazels, and many other trees, have been found under the sheets of lava in the far north of Greenland. The sea still occupied much of the lowlands of Europe.

Thus it ran as a strait between the Bay of Biscay and the Mediterranean, cutting off the Pyrenees and Spain from the rest of the continent. It swept round the north of France, covering the rich fields of Touraine and the wide flats of the Netherlands. It rolled far up the plains of the Danube and stretched thence eastward across the south of Russia into Asia.

By this time not a few of the species of shells which still people the European seas had appeared. So long have they been natives of our area that they have witnessed the rise of a great part of the continent. Some of the most stupendous changes which they have seen have taken place in the basin of the Mediterranean, where, at a comparatively recent geological period, parts of the sea-floor have been upheaved to a height of three thousand feet. It was then that the breadth of the Italian Peninsula was increased by the belt of lower hills that flanks the range of the Apennines. Then, too, Vesuvius and Etna began their eruptions. Among these later geographical events also we must place the gradual isolation of the Sea of Aral, the Caspian, and the Black Sea from the rest of the ocean, which once spread from the Arctic regions down the west of Asia, along the base of the Ural Mountains into the southeast of Europe.

The last scene in this long history is one of the most unexpected of all. Europe, having nearly its present height and outlines, is swathed deep in snow and ice. Scandinavia and Finland are one vast sheet of ice, that creeps down from the watershed into the Atlantic on the one side, and into the basin of the Baltic on the other. All the high grounds of Britain are similarly buried. The bed of the North Sea as well as of the Baltic is in great measure choked with ice. The Alps, the Pyrenees, the Carpathians, and the Caucasus send down vast glaciers into the plains at their base. Northern plants find their way south even to the Pyrenees, while the reindeer, musk-ox, lemming, and their Arctic companions roam far and wide over France.

As a result of the prolonged passage of solid masses of ice over them, the rocks on the surface of the continent, when once more laid bare to the sun, present a worn, flowing outline. They have been hollowed into basins, ground smooth, and polished. Long mounds and wide sheets of clay, gravel, and sand have been left over the low grounds, and the hollows between them are filled with innumerable tarns and lakes. Crowds of bowlders have been perched on the sides of the hills and dropped over the plains. With the advent of a milder temperature the Arctic vegetation has gradually disappeared from the plains. Driven up step by step before the advancing flora from more genial climates, it retired into the mountains and there to this day continues to maintain itself. The present Alpine flora of the Pyrenees, the Alps, Britain, and Scandinavia, is thus a living record of the ice age. The reindeer and his friends have long since been forced to return to their northern homes.

After this long succession of physical revolutions, man appears as a denizen of the Europe thus prepared for him. The earliest records of his presence reveal him as a fisher and hunter, with rude flint-pointed spear and harpoon. And doubtless for many a dim century such was his condition. He made no more impress on external nature than one of the beasts which he chased. But in course of time, as civilization grew, he asserted his claim to be one of the geographical forces of the globe. Not content with gathering the fruits and capturing the animals which he found needful for his wants, he gradually entered on a contest with Nature to subdue the earth and to possess it. Nowhere has this warfare been fought out so vigorously as on the surface of Europe. On the one hand, wide dark regions of ancient forest have given place to smiling cornfields. Peat and moor have made way for pasture and tillage. On the other hand, by the clearance of woodlands the rainfall has been so diminished that drought and barrenness have spread where verdure and luxuriance once prevailed. Rivers have been straightened and made to keep their channels, the sea has been barred back from its former shores. For many generations the surface of the continent has been covered with roads, villages, and towns, bridges, aqueducts, and canals, to which this century has added a multitudinous network of railways, with their embankments and tunnels. In short, wherever man has lived, the ground beneath him bears witness to his presence. It is slowly covered with a stratum either wholly formed by him or due in great measure to his operations. The soil under old cities has been increased to a depth of many feet by the rubbish of his buildings; the level of the streets of modern Rome stands high above that of the pavement of the Cæsars, and that again above the roadways of the early republic. Over cultivated fields his potsherds are turned up in abundance by the plow. The loam has risen within the walls of his graveyards as generation after generation has moldered into dust.

It must be owned that man, in most of his struggles with the world around him, has fought blindly for his own ultimate interests. His contest, successful for the moment, has too often led to sure and sad disaster. Stripping forests from hill and mountain, he has gained his immediate object in the possession of their abundant stores of timber; but he has laid open the slopes to be parched by drought, or to be swept bare by rain. Countries once rich in beauty, and plenteous in all that was needful for his support, are now burned and barren, or almost denuded of their soil. Gradually he has been taught by his own bitter experience, that while his aim still is to subdue the earth, he can attain it, not by setting Nature and her laws at defiance, but by enlisting them in his service. He has learned at last to be the minister and interpreter of Nature, and he finds in her a ready and unrepining slave.

In fine, looking back across the long cycles of change through which

the land has been shaped into its present form, let us realize that these geographical revolutions are not events wholly of the dim past, but that they are still in progress. So slow and measured has been their march, that even from the earliest times of human history they seem hardly to have advanced at all. But none the less are they surely and steadily transpiring around us. In the fall of rain and the flow of rivers, in the bubble of springs and the silence of frost, in the quiet creep of glaciers and the tumultuous rush of ocean-waves, in the tremor of the earthquake and the outburst of the volcano, we may recognize the same play of terrestrial forces by which the framework of the continents has been step by step evolved. In this light the familiar phenomena of our daily experience acquire an historical interest and dignity. Through them we are enabled to bring the remote past vividly before us, and to look forward hopefully to that great future in which, in the physical not less than in the moral world, man is to be a fellow worker with God.—*Proceedings of the Royal Geographical Society.*

SERPENT-CHARM.

By FELIX L. OSWALD, M. D.

THE pathology of spiritualism presents some curious parallels with that of a well-known class of physical disorders—the artificial derangements of the alimentary process by the opium-habit, and the abuse of alcoholic or pungent stimulants, which a French physiologist comprises under the name of toxicolatrous affections — the poison-manias, we might call them—and which, with all their characteristic causes, symptoms, progressive stages, direct and collateral effects, find their analogues in the half-voluntary delusion of ancient and modern miracle-mongers.

Spiritualistic as well as spirituous propensities can be transmitted by hereditary influences; both are liable to be aggravated by prolonged indulgence, to develop the symptoms of chronic diseases, and to end in hopeless delirium. The principal arguments against the use of poisonous stimulants are based upon their adventitious consequences. Dull headaches and red noses are mere trifles compared with the negative effects of habitual intoxication—loss of memory, energy, and self-respect, and of the relish for healthier food and all healthier and higher enjoyments. The worst of alcoholic blue-devils are the ghosts of departed hopes, for an unnatural passion implies many things, among which the hankering after a special kind of unwholesome stimulant is only a minor item.

For the same reason, it would be a mistake to suppose that the

mischief of anti-natural dogmas could be estimated by their direct effects—the propagation of a greater or smaller number of preposterous tenets; the chief bane of their influence is indirect and subjective, rather than objective. Not external facts only, but our own vision, they have obscured; the victims of supernaturalism have lost their critical faculty as well as their critical conscience—their standard of probability itself has been falsified. Like an all-pervading mist, the poison-vapor of mysticism has obscured the light of science, and blinded the eye of common sense to innumerable fallacies and charlatanries. St. Gregory Thaumaturgus is the patron-saint of all quacks—of mesmerists, fasting girls, blue glass and patent-medicine peddlers—as well as of indulgence-brokers. Mere dogma-worship might imply connivance, rather than blindness—a sort of *noli-me-tangere* awe more than insensibility; but also in scientific theorems where free inquiry is not only permitted but specially invited, the most obvious and palpable nonsense fails to be seen and felt. For people who have been fuddled with mysticism lose their relish for simple truth; the old *credo quod absurdum videtur* ("since it appears preposterous, I believe it") seems to be their motto.

A very characteristic instance of this abject credulity is the serpent-charm superstition. Millions of our countrymen still believe in what they call snake-charming; i. e., the ability of certain reptiles to paralyze smaller animals by the magic power of their *eyes*, a belief whose tenacity and extravagant absurdity nearly justify Pierre Gassendi's complaint that in regard to all occult phenomena the most supernatural theory is sure to become the popular one. Blacksnakes overtake their prey by superior swiftness and strangle them by superior strength; but the fact that such sluggish creatures as the Indian cobra and the American rattlesnake are able to capture birds and squirrels seemed to demand an abnormal explanation, and the demand, as usual, was equaled by the supply. Truth-loving and otherwise intelligent persons listen gravely to stories about linnets who hopped from branch to branch into the penetralia of a snake-infested bush, or swallows who paused in their headlong flight, hovered with tremulous wings for a minute or two, and then descended in a reluctant flutter toward a ditch or hedge where the enemy lay concealed, a coiled snake with a pair of twinkling optics that glittered like demons' eyes, while the doomed bird came nearer and nearer, and finally saved the serpent the trouble of swallowing it by hopping down its throat. The natives of our Southern coast States ascribe the same faculty to lizards and toads; and the darkeys of the Georgia river plantations, if asked to account for the frequent disappearance of sucking pigs, used to explain that they had been charmed away by alligators, who, without leaving their native element, were able to draw a pig clear across a ten-acre field by cocking their eyes in a peculiar way! But the arch-conjurer of our continent is still the sneaking rattlesnake, whose power for mischief is

thought to be hardly limited by the capacity of its stomach. Gratuitous malevolence, according to current stories, has often induced this symbol of the tempter to bewitch dogs and cattle, merely for the sake of testing the efficacy of its magic eyes first, and of its poison afterward; nay, a colored deacon of Navasota, Texas, affirms that he himself was once charmed by a flat-bellied rattlesnake, and favored the local weekly with a circumstantial account of his adventure. On his way home from meeting he took a short cut across a field (a sweet-potato field his neighbors suspect), and was just in the act of climbing a fence when his eye was caught by a piercing glitter in the weeds, a sudden, flash-like gleam that went through him like an electric shock, and made him grab the top rail with a convulsive grip. He tried to jump down, but could not; his legs were paralyzed, and a feeling of numbness began to creep up his body and toward his heart, while his eyes became so rigid that he could not even wink. He found that he could howl, which he did, with all his might; but, instead of being scared, the reptile wagged his tail, and came a little nearer. He gave himself up for lost, when he suddenly thought of a big prayer-book in his pocket, and in the moment when the serpent braced itself for a spring, he hurled at its head a copy of Baxter's "Saint's Rest" (Tract Society edition, 8vo), which, either by its weight or by its orthodox vigor, staggered the fiend for a second or two, during which the deacon effected his escape. The bird and squirrel stories are occasionally varied by a similar termination: the arrival of the witness broke the spell, and the squirrel hopped off, rejoicing; or the linnet perched upon the shoulder of the deponent, and twittered eloquently to express its gratitude for his timely intervention.

Only the insanity of the middle ages could excuse such superstitions; but that the subject has its difficulties is demonstrated by the variety of conjectures which have been offered for its elucidation. The serpent-charm fable has engaged the attention of different ancient and modern philosophers, but their treatment of the question is mostly what logicians call *anatreptic*, i. e., refuting without concluding anything in the affirmative, and the theories of professional zoölogists are somewhat inconsistent and unsatisfactory. Bichat speaks of a stupefying effluvium (*exhalaison hypnotique*) by which some reptiles benumb their victims; and Van der Hoeven suggests that the above-described suicidal infatuation of birds and rodents may be nothing but the well-known self-sacrificing courage of the nest-mothers in defense of their helpless brood; while some modern ophiologists (Keyserling, Cabanis, and Dr. Hitchcock) have rejected the idea that such sluggish reptiles as moccasins and rattlesnakes—unless assisted by accident or the artificial arrangements of captivity—could capture more agile animals than frogs or moles.

But the dissection of swollen rattlesnakes has revealed more feathers than moleskins, and the prairie moccasins of Kansas and Arizona would

have to crawl a long way before they could find a frog. In the sterile border-land of north Mexico and southern Texas swamps and frogs are hardly known to the untraveled natives, while the frequency of poisonous reptiles is almost unparalleled; and on a recent visit to the lower Rio Grande I found that the trade in living serpents, scorpions, and tarantulas has become a regular branch of industry, which in Cameron County, Texas, and Matamoras alone, employs a dozen professional and twenty or thirty juvenile amateurs. In a state of captivity these animals fast with the stoicism of an othodox fakir, so that the question of their proper diet becomes comparatively unimportant; but out in the prairie the *embonpoint* of the copperheads and yellow rattlesnakes suggests eupeptic habits and a liberal food-supply, though the arid soil yields neither frogs nor moles. Birds there are, in abundance; but how can the most subtle serpent secure them without incurring the suspicion of witchcraft? The opinions of the natives differ as widely as those of the above scientists. Among the less transcendental ones, some hold that the *vivoras* hunt in night-time, others that they poison the berries of the taxus-tree and surprise the birds while they are prostrated by a fit of gastritis. A rather intelligent *ranchero*, who had hauled a load of ice water and comestibles for a picnic party of American merchants and Mexican army officers, was present when the autopsy of an overgrown rattlesnake elicited a series of half-digested singing birds, and explained that the Rio Grande *vivoras* could only indulge in such luxuries since the establishment of the International Telegraph line, which caused the death of so many swift-flying birds that came in contact with the wires. This theory might satisfy the Spanish-American officers, but not an Anglo-American druggist, who had visited the upland prairies on his botanical excursions and had reasons to believe that the prosperity of the wily ophidians was not materially affected by the absence of telegraphic facilities. So he applied to one of the leading vivora-catchers and a week before my arrival in Matamoras obtained a pair of good-sized yellow rattlesnakes, which he added to a more or less happy family of lizards and blacksnakes in an empty room of his suburban cottage.

Reptilians, said he, are generally inexpensive boarders; his four lizards content themselves with a daily fly apiece, and one old horned toad has pursued the road of total abstinence to a length where even Dio Lewis would hesitate to follow; but some snakes make an exception: the *Coluber palustris*, or water-blacksnake, is almost insatiable, and the common blacksnake insists on his three daily meals with a firmness that would disgust the business-managers of a fasting girl. The rattlesnakes, too, began to crawl about and ply their tongues in a way that suggested a growing interest in the *table-d'hôte* arrangements of their new hotel, and cast furtive glances at a little mouse which had been introduced in anticipation of their wishes.

But, either through fastidiousness or a mistaken notion of duty to-

ward their fellow-lodgers, they tarried so long before they broke their fast that their host apprehended a dietetic misunderstanding, and treated them to a nest with five young sparrows the next day. Three of these died before their snakeships condescended to partake; old sparrows, rats, and cockroaches were tried with no better success. The freckled ophidians still seemed to eat under protest, "yielding, but not consenting, to injustice," as Shere Ali said. But, though their proprietor's experiments failed to explain the mystery of rattlesnake-food, he believes that they solved a more interesting problem—the question in regard to the *modus operandi* of poisonous serpents in the capture of their prey.

During the first week of their confinement his rattlesnakes disdained to chase their game, and the stupidity of the bugs and young birds made it easy enough to collar them whenever they were wanted; but one morning the *gamins* of the neighborhood caught an old blackbird and sold it to the zoölogical druggist for two pieces of stick-candy. The blacksnakes were covered up with an old apron to prevent their interference, and the *vivoras* who had fasted for twenty-four hours, rather then eat cockroaches, got one more chance at a square meal. After fluttering around in an excited way for a while, the bird settled down in a corner, and the two snakes prepared for action. They lowered their heads, and, without moving the tail-end of their bodies, approached the bird by a gradual extension of their coils; but he was all suspicion, and recommenced his fluttering before their cat-like advance had brought them within range. The snakes separated then; the female rolled herself up in the blackbird's corner and her mate took post in the center of the room, but, after readjusting their coils, neither budged an inch; they bided their time.

Dashing his head against the windows seemed to tire the bird after a while. Presently he came down, but alighted in a rather inaccessible place, took wing again, and, alighting in his old corner, finally blundered into the water-pot. He hopped out with drenched wings and devoted a few seconds to the rearrangement of his toilet, unconscious or heedless of the proximity of the female partner of the hostile alliance. She watched all his movements, and her tail quivered in a curious way when she saw him poke his head under his right wing, the one turned toward the corner; she seemed to know that he would repeat the same manœuvre on the left-wing side. He did so, and she had him directly. Drawing herself up, she poised her neck like a dart, braced herself by contracting the rear coils, and let drive. A loud screech, a few feathers flying, and a terrified bird darting through the room like a blind chicken—cause and effect coinciding with shot-like suddenness.

Instead of following him she returned to her favorite nook, where she was soon after joined by her mate. The difficult part of the job was done. Three or four times the bird managed to take wing, stag-

gered around in a circle once or twice, and then sat still. The chemicals began to operate. First its legs and then its wings commenced to tremble; trying to stand upright, it put its feet farther and farther apart and finally spread its wings, but to no purpose; a convulsive tremor seized it, and with a gasp it fell over on its side; and only at that moment did the snakes glide up to take possession of their prey. The same experiment was tried with a ground-squirrel and two half-grown chickens, and always with an analogous result. No animal likely to offer serious resistance was captured outright by the rattlesnakes. They managed to fetch it a bite and let it go, relying on the virus to do the rest.

Two causes conspire to make this the only practicable course for a moderate-sized reptile not gifted with the wildcat-like agility of the blacksnake. In the first place the fangs of a serpent are not rigid like those of a fox or shark, but movable and rather slender, and utterly unfit for seizing and holding struggling animals, excepting those of the smallest size. The poison-teeth of a rattlesnake are even retractile, and, being only attached to the palate by an elastic ligament, can be drawn backward by a temporal muscle, like the blade of a clasp-knife into its handle, and are too feeble to penetrate the skin of a tapir or hog, which animals attack and devour the most poisonous snakes with perfect impunity. With such teeth they can only administer a snap-bite.

On the other hand, the effect of the poison is never instantaneous: a man can walk two or three miles before his bitten leg begins to swell; a snake-bitten dog can run for a couple of minutes without exhibiting any signs of uneasiness. A large bird may possibly fly away and out of sight, while even the smallest birds are able to take wing for a moment, and rats to make a dash toward their holes. The snakes know this, and bide their time with all the complacency of a veteran angler who holds a fish by a long line and permits it to exhaust its strength before he pulls home.

In the course of the countless ages during which men and serpents have been coinhabitants of this planet, it is not only possible but certain that some hunters or wood-cutters happened to witness the last act of an oft-repeated tragedy, the strange movements and subsequent convulsions of a bird or little rodent hopping, perhaps, in a helpless way around or even toward a snake that had watched it with glittering eyes. The first act they could only have seen indistinctly and from a distance, since their approach would have saved the victim by scaring it away in time. So they jumped at the conclusion that the *eyes* of the reptile had bewitched the poor creature, and found believers who would be very sorry to demolish such a delightfully mystic theory by prosaic investigations; as for cognate reasons our spiritualistic contemporaries prefer to believe that the writing on the slate was produced by the "dear friend in the spirit-land," rather than

by the evaporation of sal enixum or muriate of ammonia; not because they are ignorant of the fact that minutes and hours may intervene between a cause and its visible effect, but because they yearn to substitute mystery for simple and intelligible truth. Not everybody could be expected to investigate the matter by expensive and laborious experiments, but all unmystified human beings could and should be able to foresee the result in regard to the main point, or suspend their opinion altogether rather than accept the enchantment theory. Not their poverty but their will consents. The witchcraft delusion had long been exposed in all its bottomless absurdity when people still believed in weather-wizards, were-wolves, and broomstick excursions through the chimney; and, after ninety-eight "mediums" have been caught *in flagranti*, the ninety-ninth can collect a roomful of grown-up persons who are kind enough to think it possible that disembodied souls could handle a fiddle-stick, or that flying beans and cherry-stones emanate from a spirit-popgun.

Venomous serpents would disappear without the aid of St. Patrick if they had to rely on the charm of their eyes for a dinner; for a rattlesnake, deprived of its chemicals, would starve as surely as a "magic slate-writing medium" in a like predicament.

NOVELTY IN PATENTS.

By OLIVER E. LYMAN.

BY the statute of 1870 it was enacted that an invention, to be patentable, must possess, among other qualifications, that of newness or novelty. But what constitutes novelty is not defined. The solution of the question is left to be determined according to the circumstances of each particular case. It is this fact which makes the question such a difficult one to be answered; for in each case there is generally some little element present which distinguishes it from other cases, and makes it impossible to frame one decided rule of universal application. The question is also rendered less easy of solution from the fact that it comes up most frequently in its most difficult aspect—in cases of infringement, where the point under discussion is, whether the alleged invention is, or is not, *substantially identical* with some prior existing thing, which has been in common use here or described in some patent or printed publication. Yet, despite the nicety in which this question of novelty is involved, we are not compelled to leave it entirely unsolved. A careful study of the subject discloses certain principles which by their application somewhat prune down the difficulty. We are fortunate in being able to approach the question from two sides; for, as was true in the case of the two-faced

shield, over which those two knights of old story wrangled so long, an inspection of the subject from two points of observation decidedly simplifies matters. The first of these methods of studying the subject I would designate the negative, and the second the positive method. By the negative method we deduce certain principles in regard to cases which have at first sight a color of novelty, but are not novel, so as to be patentable. By the positive method we arrive at certain conclusions in regard to what actually constitutes novelty in a patentable sense.

I propose to discuss, first: What cases, at first sight possessing novelty, do not actually possess novelty? A study of cases warrants us in accepting, as a first principle, that every change or mere substitution of a mechanical equivalent is not necessarily a patentable novelty; for it may not be substantially unlike some prior thing. We may have, for instance, a machine, comprising, say, three distinct parts. A man, not the inventor, substitutes for each of these parts other equivalents, producing the same results. This is not a patentable invention. Even if the products be better or cheaper, it is at most only an improvement upon a former invention, and can be used only with the permission of the former patentee.

I spoke above of a "mechanical equivalent." This needs to be defined in order that we may have a clear comprehension of the above principle. To define it, however, is not so easy. Mr. Parsons has said that "he would be a very acute man who could certainly discern, or a very bold man who would certainly assert, what is meant by a mechanical equivalent." At the risk of being considered bold, certain judges have, nevertheless, ventured to attack the Gordian knot. We find one definition in Smith *vs.* Downing, 1 Fisher's Patent Cases, 87: "By equivalents in machinery is usually meant merely the substitution of one mechanical power for another, or one obvious and customary mode for another, of effecting a like result." This definition is not sufficiently explicit. A better one is to be found in Carter *vs.* Baker, 4 Fisher's Patent Cases, 409: "When, in mechanics, one device does a particular thing, or accomplishes a particular result, every other device *known* and *used* in mechanics, which skillful and experienced workmen know will produce the same result, or do the same particular thing, is a known mechanical substitute for the first device mentioned for doing the same thing, or accomplishing the same result. It is sufficient to constitute a known mechanical substitute that, when a skillful mechanic sees one device doing a particular thing, he knows the other device, whose uses he is acquainted with, will do the same thing."

This definition not only covers those elements which come strictly under the head of mechanics, but is also our guide in determining what constitutes an equivalent in an "art," or a "manufacture," or a "composition of matter." The definition of an equivalent of any substance in a composition made of several ingredients, for example, is, in

accordance with our guide, any other substance having similar properties and producing substantially the same effect.

So much for the first class of cases, which at first sight are apparently novel, but which in reality are not novel, so as to be patentable.

Another class of cases against which the verdict of "no novelty" must be pronounced is where a new use is made of an old invention. This is no new invention. The mere application of an old invention or means or method of operation to a new use does not amount to a patentable novelty. There is nothing new made by such a proceeding. The use of the thing is perhaps enlarged and that is all. It was upon this principle that adverse decisions were rendered to the claimants in the cases of Losh *vs.* Hague, and Howe *vs.* Abbott. In the first of these, which is reported in 1 Webster's Patent Cases, 205, it was held that the application to railway-carriages of a kind of wheel previously in use on common carriages would not support a patent. In the second case, which is reported in 2 Story, 190, the patentee claimed as his invention a process of curling palm-leaf for mattresses. It appeared from the evidence that horse-hair had for a long time been prepared by the same process and devoted to the same purpose. In delivering his opinion Judge Story said: "The application of an old process to manufacture an article to which it had never before been applied, is not a patentable invention. There must be some new process or some new machinery used to produce the result. . . . He who produces an old result by a new mode or process is entitled to a patent for that mode or process. But he can not have a patent for a result merely without using some new mode or process to produce it."

Allied to this question of double use is the question whether a patent can be taken for a particular use of a known machine, when the plaintiff is the first to discover the benefit of such use. As may be supposed, from the place in which I have inserted this question, the answer is "No." And there is justice in the answer; for a man is entitled to all the benefit of an article which he has invented and patented. The man who happens to discover an additional use to which the invention may be applied does not by that discovery and application create a patentable novelty. He devises no new combination of machinery, no new process. Hear what Lord Chelmsford said on the subject. His opinion is to be found in Ralston *vs.* Smith, 11 H. L. C., 256. In this case, by the way, the plaintiff had discovered that by giving a differential motion to different parts of an old machine, a power existing in it might be developed and brought into action. Lord Chelmsford, after stating that he saw no new process, or new combination of machinery, said, "It appears to me that such a discovery is not the subject of a patent." And the same doctrine is laid down in the case of Tetley *vs.* Easton, 2 C. B. (N. S.), 706.

There is another class of cases which demands attention. It sometimes happens that a man seeks a patent for a mere aggregation of

things—as, for example, a hammer with a screw-driver inserted in one end of the handle and an awl in the other. The absurdity of granting a patent in such a case is very apparent, and it is no wonder that in the case of Swift *vs.* Whizen, 3 Fisher's Patent Cases, 357, a decision was given against the patentability of the very aggregation given above as an example.

A distinction should be made between such aggregations, when the whole is easily divisible into its component parts, and aggregations where the individuality of the component parts is lost. I would revert to the hammer and screw-driver as an example of what I mean by the divisibility of the whole. The hammer can be taken by itself, the awl by itself, and the screw-driver by itself, and used. As an example of what I mean by the loss of individuality, take the combined glass-cutter, screw-driver, can-opener, etc., which have been on sale in the streets of late. Here there is but one invention in reality, and the various parts are merged in one whole. The novelty lies in the new combination of the glass-cutter, can-opener, etc., in such a way that the utility of the parts would be lost by division.

We have now left to discuss the general rule that a mere alteration in the form, size, material, or proportions of an existing device is not such a change as to produce patentable novelty. This rule is related to the first one given in regard to the substitution of mechanical equivalents, but it is much wider in its scope. It is laid down in express terms in the second section of the act of February 21, 1793. This declaratory law was not reënacted in the patent act of 1836, yet necessity and justice compel its recognition. For, as was said in Winans *vs.* Denmead, 15 Howard, 341: "It is a principle which necessarily makes part of every system of law granting patents for new inventions. Merely to change the form of a machine is the work of a constructor, not of an inventor; such a change can not be deemed an invention."

A very interesting case on this point is reported in 11 Howard, 248 (Hotchkiss *vs.* Greenwood). It relates particularly to the substitution of a new material. In this case a new clay knob was substituted for a metallic knob. It was claimed that there was a patentable novelty. But there was no new mechanical device or contrivance. The knob was not new. The metallic shank and spindle were not new; nor the dovetail form of the cavity in the knob, nor the means by which the metallic shank was securely fastened therein. The only change was in the substitution of a clay for the former metallic knob. Judge Nelson very properly decided that there was no such novelty in this as to warrant the granting of a patent. "This of itself," said he, "can never be the subject of a patent. No one will pretend that a machine, made in whole or in part of materials better adapted to the purpose for which it is used than the materials of which the old one is constructed, and for that reason better and cheaper, can be dis-

tinguished from the old one; or, in the sense of the patent law, can entitle the manufacturer to a patent."

So much for the negative method of investigation of the subject of novelty in patents. We have discussed many cases of apparent novelty and have seen in what novelty does *not* consist. In accordance with the old saw, "You tell me what you're *not*, and I'll tell you what you are," we are now prepared to turn to what I have called the positive method of investigation and learn what *is* patentable novelty.

To answer the question, What is novel, so as to be patentable? is easier than the one we discussed in the first part of this paper. In a few words, there is patentable novelty when there is a different principle of operation; when there is a different result in kind, or when there is a new combination. It is for one or another of these reasons that a patent is ever granted. There may be other grounds apparently, but a closer investigation will show them to be but another species of the above family, and consequently to be classified with them in their application.

The first two of the three principles enumerated can best be treated of together. To repeat, there will be novelty when either the manufacture produced, or the manner of producing an old one is new. In the former case there must be something *substantially* new, different from what was before known. In the latter case the principle of the machine must be different. And, as I have shown before, a mere change of the form or proportions will not suffice, if both are the same in principle, structure, mode of operation, and produce the same result. This is true even if there is some small variance in some small matter for the purpose of evasion, or a color for a patent. There must be some principles different from any previously known.

This opens up the ancillary and important question, What is meant by "the principles of a machine"?

In Whittemore *vs.* Cutter, 1 Gall., 478, Judge Story says: "By the principles of a machine is not meant the original elementary principles of motion which philosophy and science have discovered, but the *modus operandi*, the peculiar manner or device for producing any given effect. If the same effects are produced by two machines by the same mode of operation, the principles of each are the same. If the same effects are produced, but by combinations of machinery operating substantially in a different manner, the principles are different."

In deciding whether the principles of a machine are new, there is one block over which we may stumble and which we should take care to avoid. There is danger of confusing form with principle. The question of what constitutes form and what principle is frequently a very nice question to decide. Judge Washington, in Treadwell *vs.* Bladen, 4 Wash., 706, has pointed out a road out of the confusion. "The safest guide," says he, "to accuracy in making the distinction is, to ascertain what is the result to be obtained by the discovery; and

whatever is essential to that object, independent of the mere form and proportions of the thing used for the purpose, may generally, if not universally, be considered as the principle of the invention."

The third principle above enumerated, that a new combination is a patentable novelty, is well elucidated in the case of Barrett *vs.* Hull, 1 Mass., 474. This was a case for the infringement of a patent granted for "a new and useful improvement, being a mode of dyeing and finishing all kinds of silk-woven goods." Judge Story said: "A patent may be for a new combination of machines to produce certain effects; and this whether the machines constituting the combination be new or old." And in Whitney *vs.* Emmett, 1 Baldwin, 311, also the patentability of a new combination was upheld. What the learned Judge said is so good an epitome of all that has been said in the second part of this paper, that I give it, although it is merely cumulative:

"Novelty consists in producing a new substance, or an old one in a new way, by new machinery, or a new combination of the parts of an old one, operating in a peculiar, better, cheaper, or quicker method, a new mechanical employment of principles already known."

The rule in regard to new combinations, as above laid down, is most just, for the most valuable inventions consist in the combination of known mechanical powers. It makes no matter if some of the elements are old (McCormick *vs.* Talcott, 20 Howard, 405); nor even if every part of such invention can be found in some form or other among the many devices of human ingenuity. As was said in Pitts *vs.* Edmond, 2 Fisher's Patent Cases, 55, "The man who unites these powers and produces a new and important result to society is well denominated a public benefactor."

There is one important principle in regard to combinations which, although not bearing directly upon the question of novelty, yet ought to be remembered. Judge Story called attention to it in the preceding case of Barrett *vs.* Hull: "It is no infringement," he said, "of the patent to use any of the machines *separately*, if the *whole combination* be not used, for in such case the thing patented is not the separate machines, but the combination."

With this quotation I end the discussion of the question of novelty in patents. I have endeavored to make my answer as satisfactory as the difficulties of the question would allow. I have for that purpose viewed the subject from two standpoints of opposite natures and have enumerated and discussed certain principles of general application which were disclosed by this double observation. The work must at the best, however, be incomplete, for, as Mr. Parsons says, "It is obviously impossible to find precise and technical rules which always answer the question."

DEVELOPMENT OF THE HOUSE-FLY.

By M. H. ROBSON.

THE following remarks on the development of the house-fly are based on actual observation, and the appended sketches were made by Mr. G. Harkus from the microscope, with the aid of a Beales reflector.

Mr. Harkus, with whom I experimented simultaneously, was fortunate, or the reverse, in having the required ova brought to him in this way: A fly having gained access to a cold joint of lamb considerately left a sufficient supply for his examination. The objectionable part of the arrangement was probably counterbalanced by his being enabled to fix the time of deposition with tolerable certainty. This was on July 28th. The eggs (one of which is represented in Fig. 3, its diameter one thirtieth of an inch) were placed with a portion of the meat in a glass vessel, and next day the maggots had emerged as in Fig. 4 (diameter one twenty-fifth of an inch), where the ramifications of the tracheal system may be traced.

The warm weather, coupled with the indoor heat, matured the larva rapidly, the change from maggot to chrysalis (Fig. 2) being apparent at each observation, some having assumed this state on July

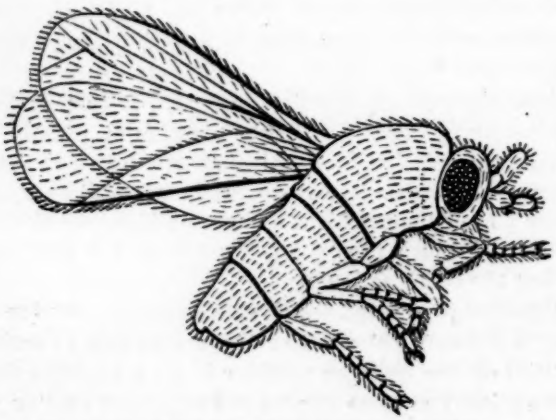

FIG. 1.—THE HOUSE-FLY (*Musca domestica*), magnified.

30th. The perfect stage was reached and the fly emerged on August 5th, or eight days from the deposition of the ova (Fig. 1).

This was a week in advance of the result obtained in my experiment, which I preferred to conduct out of doors. A piece of raw liver was exposed, which soon had eggs enough attached to it. It would appear that the fly has to some extent the power of withholding the

deposition of her ova until a suitable medium is found for the requirements of the larva.

In two or three days the maggots were at work; their activity and voracity in devouring the putrescent mass of animal matter gave it the appearance of fermentation.

For observation in the live box, any little weakness connected with the somewhat objectionable odor arising from the garbage had to be got rid of and some few maggots washed clean. Neither immersion in water nor yet compression seemed to inconvenience them appreciably;

FIG. 2.—CHRYSALIS OF HOUSE-FLY, July 20, 1878, × 40.

FIG. 3.—EGG OF HOUSE-FLY, July 28, 1878, × 30.

their leathery integument is not easily ruptured, and is sufficiently translucent to render the trachea, as well as the undulatory vermicular movement of the internal organs, apparent throughout under a low power; in fact, from its toughness, transparency, and strength, the larva is an excellent object for microscopic examination. When the animal matter was devoured, the maggots moved restlessly about, changing in color from yellowish-white to brownish-red; the cuticle became dense and opaque; motion gradually ceased, until the perfect insect emerged by forcing of the segments of the anterior end of the shell, occupying from fourteen to fifteen days in completing its series of life-changes.

Mr. Harkus's part of the experiment appears to be useful so far as to show the adaptability of the fly and its ova to circumstances, and that the larva assumes the chrysalid state when its supply of food becomes exhausted, although otherwise immature (in this case the animal matter given them would dry up), instead of dying from starvation.

The chrysalis and fly in his examples are undersized and impoverished, compared to those permitted to feed in a semi-fluid mass of animal matter.

In autumn the house-fly seems specially the victim to the attacks of a parasitic fungus (*Empusa muscæ*), and may be seen glued, as it were, to walls, a white powdery growth appearing at the segments of its body (the spores of the fungus). This vegetable pest is similar to, if not identical with, the parasite which causes so much destruction among fish in aquariums, and last year even attacked salmon in some English rivers.

The cause of the fly becoming so firmly attached to dry surfaces is this: The two pulvilli which, with two strong curved claws (perhaps best seen with the flesh-fly, *Musca vomitoria*, as a subject), terminate

FIG. 4.—MAGGOT OF HOUSE-FLY, July 29, 1878, × 25.

the foot, are surrounded by a fringe of tubular hairs, each ending with a disk or sucker, through which a glutinous fluid exudes. These form the points of attachment, enabling the insect to walk in any position, the action of the two claws detaching these points as the fly moves along.

When the ravages of the parasite have sufficiently weakened the fly by the destruction of its viscera, etc., it becomes incapable of active movement, and, remaining too long in a place, the viscid fluid continues to exude, and then the fly "sticks to the wall."—*Science Gossip.*

FOOD AND FEEDING.

BY SIR HENRY THOMPSON.

III.

I HAVE already said that, among all civilized nations, wine in some form has for centuries been highly appreciated as a gastronomic accompaniment to food. I can not and do not attempt to deny it this position. Whether such employment of it is advantageous from a dietetic or physiological point of view is altogether another question. I am of opinion that the *habitual* use of wine, beer, or spirits is a dietetic error, say, for nineteen persons out of twenty. In other words, the great majority of the people, at any age or of either sex, will enjoy better health, both of body and mind, and will live longer, without any alcoholic drinks whatever, than with habitual indulgence in their use, even although such use be what is popularly understood as moderate. But I do not aver that any particular harm results from the habit of now and then enjoying a glass of really fine, pure wine—and, rare as

this is, I do not think any other is worth consuming—just as one may occasionally enjoy a particularly choice dish; neither the one nor the other, perhaps, being sufficiently innocuous or digestible for frequent, much less for habitual use. Then I frankly admit that there are some persons—in the aggregate not a few—who may take small quantities of genuine light wine or beer with very little if any appreciable injury. For these persons such drinks may be put in the category of luxuries permissible within certain limits or conditions; and of such luxuries let tobacco-smoking be another example. No one probably is any better for tobacco; and some people are undoubtedly injured by it; while others find it absolutely poisonous, and can not inhale even a small quantity of the smoke without instantly feeling sick or ill. And some few indulge the moderate use of tobacco all their lives without any evil effects, at all events that are perceptible to themselves or to others.

Relative to these matters, every man ought to deal carefully and faithfully with himself, watching rigorously the effects of the smallest license on his mental and bodily states, and boldly denying himself the use of a luxurious habit if he finds any signs of harm arising therefrom. And he must perform the difficult task with a profound conviction that his judgment is very prone to bias on the side of indulgence, since the luxurious habit is so agreeable, and to refrain therefrom in relation to himself and to the present opinion of society, so difficult. Be it remarked, however, that the opinion of society is notably and rapidly changing relative to the point in question.

Having premised thus much, I have only now to say, first, that wine, in relation to dinner, should be served during the repast; it should never be taken, in any form or under any circumstances, before, that is, on an empty stomach, and rarely after the meal is finished. Regarded from a gastronomic point of view alone, nothing should appear after fruit but a small glass of cognac or liqueur, and coffee. The postprandial habit of drinking glass after glass even of the finest growths of the Gironde, or of the most mature or mellow shipments from Oporto, is doubtless a pleasant, but, in the end, for many persons, a costly indulgence.

Secondly, whatever wine is given should be the most sound and unsophisticated of its kind which can be procured. The host had far better produce only a bottle or two of sound *bourgeois* wine from Bordeaux—and most excellent wine may be found under such a denomination—with no pretense of a meretricious title, or other worthless finery about it, than an array of fictitious mixtures with pretentious labels procured from an advertising cheap wine-house. I could only speak in terms of contempt and disgust, did I not feel pity for the deluded victims, of the unscrupulous use of the time-honored and historical titles which advertisers shamelessly flaunt on bottles of worthless compounds by means of showy labels, in lists and pamphlets

of portentous length, and by placards sown broadcast through the country. So that one may buy "Lafite" or "Margaux"—"Chambertin" or "Nuits"—'47 port, or even '34—at any village store! No terms can be too strong to characterize such trade.

If fine wines of unquestionable character and vintage are to be produced, there are only two ways of possessing them: one, by finding some wine-merchant of long standing and reputation who will do an applicant the favor to furnish them, and the price must be large for quality and age. We may be certain that such a one will never advertise: no man who really has the *grands vins* of esteemed vintages in his cellar need spend a shilling in advertisements, for he confers a favor on his customer by parting with such stock. But better and more satisfactory is it to obtain from time to time a piece or two of wine, of high character and reputed vintage, when they are to be had, just fit to bottle, and lay them down for years until ripe for use. Commencing thus in early life, a man's cellar becomes in twenty or thirty years a possession of interest and value, and he can always produce at his little dinners, for those who can appreciate it, something curiously fine, and free at all events from the deleterious qualities of new and fictitious wines.

Briefly: the rule, by general gastronomic consent, for those who indulge in the luxury of wine, is to offer a glass of light pale sherry or dry Sauterne after soup; a delicate Rhine wine, if required, after fish; a glass of Bordeaux with the joint of mutton; the same, or champagne—dry, but with some true vinous character in it, and not the tasteless spirit-and-water just now enjoying an evanescent popularity—during the *entrées;* the best red wine in the cellar, Bordeaux or Burgundy, with the grouse or other roast game; and—but this ought to suffice, even for that exceptional individual who is supposed to be little if at all injured by "moderate" potations. With the ice or dessert, a glass of full-flavored but matured champagne, or a liqueur, may be served; but at this point dietetic admonitions are out of place, and we have already sacrificed to luxury. The value of a cigarette at this moment is that with the first whiff of its fragrance the palate ceases to demand either food or wine. After smoke the power to appreciate good wine is lost, and no judicious host cares to open a fresh bottle from his best bin for the smoker, nor will the former be blamed by any man for a disinclination to do so.

For unquestionably tobacco is an ally of temperance; certainly it is so in the estimation of the gourmet. A relationship for him of the most perfect order is that which subsists between coffee and fragrant smoke. While wine and tobacco are antipathetic, the one affecting injuriously all that is grateful in the other, the aroma of coffee "marries" perfectly with the perfume of the finest leaf. Among the Mussulmans this relationship is recognized to the fullest extent; and also throughout the Continent the use of coffee, which is almost symboli-

cal of temperate habits, is intimately associated with the cigarette or cigar. Only by the uncultured classes of Great Britain and of other northern nations, who appear to possess the most insensitive palates in Europe, have smoke and alcoholic drinks been closely associated. By such, tobacco and spirit have been sought chiefly as drugs, and are taken mainly for their effects on the nervous system—the easy but disastrous means of becoming stupid, besotted, or drunk. People of cultivated tastes, on the other hand, select their tobacco or their wines, not for their qualities as drugs, but for those subtler attributes of flavor and perfume, which exist often in inverse proportion to the injurious narcotic ingredients; which latter are as much as possible avoided, or are accepted chiefly for the sake of the former.

Before quitting the subject of dining it must be said that, after all, those who drink water with that meal probably enjoy food more than those who drink wine. They have generally better appetite and digestion, and they certainly preserve an appreciative palate longer than the wine-drinker. Water is so important an element to them, that they are not indifferent to its quality and source. As for the large class which can not help itself in this matter, the importance of an ample supply of uncontaminated water can not be overrated. The quality of that which is furnished to the population of London is inferior, and the only mode of storing it possible to the majority renders it dangerous to health. Disease and intemperance are largely produced by neglect in relation to these two matters. It would be invidious, perhaps, to say what particular question of home or foreign politics could be spared, that Parliament might discuss a matter of such pressing urgency as a pure water-supply; or to specify what particular part of our enormous expenditure, compulsory and voluntary, might be better employed than at present, by diverting a portion to the attainment of that end. But for those who can afford to buy water no purer exists in any natural sources than that of our own Malvern springs, and these are aerated and provided in the form of soda and potash waters of unexceptionable quality. Pure water, charged with gas, does not keep so long as a water to which a little soda or potash is added; but for this purpose six to eight grains in each bottle suffice—a larger quantity is undesirable. All the great makers of these beverages have now their own artesian wells or other equally trustworthy sources, so that English aerated waters are unrivaled in excellence. On the other hand, the foreign *siphon*, made, as it often is, at any chemist's shop, and from the water of the nearest source, is a very uncertain production. Probably our traveling fellow countrymen owe their attacks of fever more to drinking water contaminated by sewage matter than to the malarious influences which pervade certain districts of southern Europe. The only water safe for the traveler to drink is a natural mineral water, and such is now always procurable throughout Europe, except in very remote or unfrequented

places.* In the latter circumstances no admixture of wine or spirit counteracts the poison in tainted water, and makes it safe to drink, as people often delight to believe; but the simple process of boiling it renders it perfectly harmless; and this result is readily attained in any locality by making weak tea, to be taken hot or cold; or in making toast-water, barley-water, lemonade, etc. The table-waters now so largely imported into this country from Germany and France contain a considerable proportion of mineral matter in solution, and, while they are wholesome as regards freedom from organic impurities, are, of course, less perfect for daily use than absolutely pure waters, such as those above referred to. Vaunted frequently as possessing certain medicinal properties, this very fact ought to prohibit their constant use as dietetic agents for habitual consumption, inasmuch as we do not require drugs as diet, but only as occasional correctives. Among them, the natural Selters, Apollinaris, Gieshübel, and St. Galmier—but of this latter some of the sources are inferior to others, the best appearing now to be chiefly retained for Paris—are perhaps among the most satisfactory within our reach. A dash of lemon-juice and a thin cutting of the peel form sometimes an agreeable addition. I am compelled to say that the sweet compounds and fruity juices which have of late been produced as dinner-drinks, and apparently in competition with wine, are rarely wholesome adjuncts to a dinner. Such liquids rapidly develop indigestible acid products in the stomachs of many persons; while, for all, the sipping of sweet fluids during a meal tends to diminish appetite, as well as the faculty of appreciating good cookery. If wine is refused, let the drink be of pure water—with a sparkle of gas in it, or a slight acid in it if you will—but in obedience both to gastronomic and dietetic laws let it be free from sugar. No doubt there are exceptional circumstances in which fruity juices, if not very sweet, can be taken freely. Thus I have rarely quaffed more delicious liquor at dinner in the warm autumn of southern Europe, notably in Spain, than that afforded by ample slices of a watermelon, which fill the mouth with cool, fragrant liquid; so slight is the amount of solid matter, that it only just serves to contain the abundant, delicate juices of the fruit grown in those climates. Here the saccharine matter is present only in small proportion.

Before concluding, a remark or two may be permitted in reference to that great British institution, the public dinner. Its utility must, I suppose, be conceded, since, for a vast number of charitable and other interests, the condition of commanding once a year the ear of the British public for an exposition of their claims seems in no other way at

* Throughout France, St. Galmier; in Germany, Selters; in Austria and Bohemia, Gieshübel, are always obtainable, being the table-water of most repute, in each case respectively, of the country itself. In all chief places in Italy, either Selters or St. Galmier, often both, are supplied by the hotels. In Spain, these are not at present to be had, but the alternatives recommended are easily obtained.

present attainable. A royal or noble chairman, a portentous *menu*, an unstinted supply of wine, such as it is, and after-dinner speeches, in variety, form an *ensemble* which appears to be attractive to the great body of "supporters." On the other hand, those whose presence is enforced by the claim of duty find these banquets too numerous and too long. The noise and bustle, the badly-served although pretentious dinner, the glare of gas and the polluted air, the long, desultory, and unmeaning speeches, interspersed with musical performances—which, however admirable in themselves, extend unduly a programme already too comprehensive—unfit many a man, seriously occupied, for the engagements of the morrow. Might it not be worth trying the experiment of offering fewer dishes, better service, and abolishing half the toasts? Might it not be possible to limit the necessary and essential toasts of a public dinner to the number of three or four—these to be followed only by a few subordinate toasts associated with the minor interests of the special object of the dinner? With the utmost deference to long-received usage, and after some little consideration, I venture to suggest that the following programme would at all events be an improvement on the present system, if such it can be called:

The first toast, or toasts, by which we declare our fidelity to the Crown, and our loyalty to the person of the Sovereign, as well as to the royal family, to remain, by universal consent, as before. The next, or patriotic toasts, unlike the preceding, are regarded as demanding response, often from several persons, and here it is that time is generally wasted. These might therefore be advantageously compressed into one, which need not be limited to the military and naval services, although it would of course include them. The object might be attained by constituting a single comprehensive but truly patriotic toast, viz., "Our great national institutions," which are easily defined. Supposing them to be regarded as seven in number, a response might be provided for from any two, according to the speakers present and the nature of the special object. These institutions fall naturally into order, as—1. Parliament: its leaders. 2. Justice: the judges. 3. The military and naval forces: their officers. 4. Education: heads of universities and public schools. 5. Religion: its ministers. 6. Science and art: heads of societies, academies, colleges. 7. Literature and the Press: distinguished writers.

The next to be "the toast of the evening": in other words, the particular subject of the dinner. After this would follow the healths of officers connected with the subject, visitors, etc., if necessary.

I confess I see no reason why the military and naval forces, however profound our respect and our gratitude for their great services to the nation must be—and in this matter I yield to no man—should invariably occupy a toast and speech, to be responded to by at least two, often by three officers, while the other great and scarcely less important interests should be left out of consideration altogether, or

be only occasionally introduced. The toast of "national institutions" would mostly insure to the chairman and managers of the dinner an opportunity of obtaining two good speakers from different interests in reply—say, one for Justice and the other for Religion; one for Parliament or the Services, and the other for Science or Literature, and so forth. Thus all the varied elements of our national life would receive in their turn a due share of attention from the great mass of public diners, and better speeches would probably be secured than by the present mode.

I confess this is rather an episode; but the subject of "toasts" is so interwoven with the management of the public dinner that I have ventured to introduce it. I even dare to think that the proposition may be not unlikely to receive the support of "the chair," the duties of which, with a long array of toasts, are sometimes excessively onerous; only more so, be it recollected, in degree than those, of a humbler kind, which are entailed on many of the guests who are compelled to assist.

In concluding this imperfect sketch of the very large subject indicated by the title of my paper, I desire to express my strong sense of its manifold shortcomings, especially by way of omission. Desiring to call attention, in the shortest possible compass, to a great number of what appear to me to be important considerations in connection with the arts of selecting, preparing, and serving food, I have doubtless often failed to be explicit in the effort to be brief. It would have been an easier task to illustrate these considerations at greater length, and to have exceeded the limits of a couple of articles; and I might thus perhaps also have avoided, in dealing with some topics, a tone in statement more positive than circumstances may have warranted. Gastronomic tastes necessarily differ, as races, habits, digestive force, and supplies of food also differ; and it becomes no man to be too dogmatic in treating of these matters. *De gustibus non est disputandum* is in no instance more true than in relation to the tastes of the palate. Still, if any rational canons are to be laid down in connection with food and feeding, it is absolutely necessary that something more than the chemical and physiological bearings of the subject should be taken into consideration. With these it is unquestionably essential for any one who treats of my subject to be familiar; but no less necessary is it to possess some natural taste and experience in the cultivation of the gustatory sense; just as a cultivation of the perception of color and a sensibility to the charm of harmoniously combined tints are necessary to an intelligent enjoyment of the visual sense and to the understanding of its powers. Hence the treatment of the whole subject must inevitably be pervaded to some extent by the personal idiosyncrasy and predilections of the individual. It is this fact, no doubt, which, operating in relation to the numerous writers on cookery, has tended to produce some of the com-

plication and confusion which often appears in culinary directions and receipts. But the gastronomic art is a simpler one than the effusions of some of its professors might lead the wholly uneducated to believe; and the complicated productions originated by some of its past and greatest practitioners are as unnecessary as are the long and complicated prescriptions formerly in vogue with the leading physicians of past time. Both were the natural outgrowth of an age when every branch of technical education was a "mystery," and when those who had attained the meaning thereof magnified their craft in the eyes of the vulgar by obscuring what is simple in a cloud of pedantic terms and processes. But that age and its delusions are passing away, and it is high time for simplicity in the practice of cookery to take the place of some useless and extravagant combinations and treatment which tradition has handed down.

At the present day it appears desirable, before all things, to secure the highest quality of all produce, both animal and vegetable; a respectable standard being rarely attained throughout our country in regard to the products of the latter kingdom. Great Britain has long held, and still maintains, the first place as to quality for her beef and mutton; in no other country in Europe—I can not speak of America—is it possible to obtain these meats so tender, juicy, and well developed. The saddle, the haunch, the sirloin, and the round, so admirable on occasions, are only in danger of suffering here, like intimate friends, from too great familiarity with their charms. But even our standard of quality in meat has been gradually lowered, from the closer struggle, year by year, to produce a fat animal in a shorter space of time than formerly; a result which is accomplished by commencing to feed almost exclusively on oil-cake at a very early period of life. The result of this process is, that size and weight are attained by a deposit of fat, rather than by the construction of muscular fiber, which alone is true meat; while, as a necessary consequence, the characteristic flavor and other qualities of fully developed beef and mutton are greatly wanting in modern meat.

Much more unsatisfactory is the supply of vegetable and dairy produce to our great city, particularly of the former. It must be confessed that our market at Covent Garden, in relation to capabilities for effective distribution of fresh vegetables, etc., would disgrace a town one fifth of the size of London. Nineteen twentieths of its inhabitants can not obtain fresh green food on any terms, and those who succeed pay an exorbitant price. I think I am right in saying that a really new-laid egg is a luxury which a millionaire can scarcely insure by purchase; he may keep fowls, and with due care obtain it, not otherwise. The great staple of our bread, commonly called "baker's bread," is unpalatable and indigestible; and I suppose no thoughtful or prudent consumer would, unless compelled, eat it habitually—used as it nevertheless is by the great majority of the inhabitants of this

great city—any more than he would select a steak from the coarse beef whose proper destination is the stock-pot. Let any one compare the facilities which exist in most foreign towns for obtaining the three important articles of diet just named, with the parallel conditions afforded by London, and the inferiority of the latter will be so manifest as to become matter of humiliation to an Englishman. I do not raise any question of comparison between our own markets and the Halles Centrales of Paris, covering as they do nearly five acres of closely utilized space, with enormous vaults beneath, in direct communication by tram-road with the railways; nor of the well-stocked Marché St. Honoré, and others of less note. To many among the thousands of tourists who frequent the public buildings of Paris, an early morning survey of the fish, flesh, dairy produce, vegetables, fruit, and flowers, which the Halles Centrales display, and the scarcely less remarkable exhibition of Parisian and provincial life brought together there, present one of the most interesting and truly foreign spectacles which the city affords.

To the long list of needed reforms I have ventured to advocate in connection with this subject, I must add the want of ample and accessible markets in various parts of London, for what is known as country produce. I do this not only in the interest of the millions who, like myself, are compelled to seek their food within the limits of Cockayne; but also in the interest of our country gardeners and housewives, who ought to be able to supply us with poultry, vegetables, and eggs, better than the gardeners and housewives of France, on whom at present we so largely depend. We may well be grateful to these small cultivators, who by their industry and energy supply our deficiencies; but the fact that they do so does not redound to the credit of our countrymen.

No doubt, as regards security, liberty, locomotive facilities, etc., Cockayne is a tolerably comfortable and pleasant place to live in; nevertheless, it is certainly true that greater intelligence, more enterprise, and better organization—perhaps of the coöperative kind—are much required, in order to improve not only the sources and quality of our food, but also some of our manners and customs in relation to selecting, preparing, and serving it.—*Nineteenth Century.*

A REMARKABLE COINCIDENCE.

LETTER FROM DR. GEORGE M. BEARD.

To the Editors of the Popular Science Monthly:

IN the April number of your Journal for this year (1879), I discussed the subject of coincidences as one of the six sources of error in experimenting with living human beings, and stated in substance that this department of logic had been most imperfectly studied, and that the

mathematical doctrine of chances especially had been abused and misunderstood, to the great detriment of science.

The following very remarkable correspondence illustrates my position so forcibly that I beg leave to present it to your readers.

The first letter is a so-called "April-fool" letter, as the date suggests, and is wholly imaginative. It was written for amusement purely, and obtained a very different reply from what was expected.

The author of the communication is a well-known merchant of this city, and a friend of mine. The person who replied is also well known in the region where he resides.

This coincidence is certainly one of the most remarkable of any recorded in the history either of logic or of delusions.

202 Columbia Heights, Brooklyn,
April 1, 1879.

My dear Sister Velina: You will no doubt be somewhat surprised to receive a letter from me, but I have a little matter of business, and if you will attend to it you will place me under obligations to your good self.

Some time ago a man by the name of John Nasium lived in New York. His father was a Southerner, and died last summer of yellow fever. He had two brothers, James and George. The former, some years ago, went to California, and the latter, I understand, resides somewhere in Kansas.

This John Nasium seems to have been the black sheep of the family, and when he left New York he did not leave a very good record behind him. He went from here to Toledo, Ohio, and afterward, we hear, he went to Tecumseh, Michigan, no doubt thinking that in a quiet country place he would be more secluded than he could be in a city. I and several of my friends would like to get track of him, if it can be done quietly, and without exciting any suspicion. He may have changed his name, and so I will describe the man, as nearly as I can, which may be some help to you. John I never knew very well, but his brother Jem, as they called him here, I knew very well indeed. John is rather tall, weighing about 180 pounds, I should think. He stoops a little, and is slightly lame in the left leg. You would not observe his lameness unless you were to pay particular attention to him while walking. His hair is a dark sandy color, in fact almost a red, and his side-whiskers are almost the same color, but a little darker. He is about thirty-eight years of age, but really does not look over thirty. His eyes are a very dark brown, and the left eye looks a little peculiar, i. e., unlike the other—looks as if some time or another a cataract had been removed by an operation. To look at him, you would at once see a difference in his eyes, and yet I can not describe the difference any better than I have done. While he lived here he usually wore his hair rather long, and carried himself in a style peculiar to the Southerner.

Now, perhaps the best and most prudent way for you to do would be for you to go up and read this letter to Uncle Hiram first. He is a very careful, discreet man, and he can make inquiries and excite less suspicion than you could.

I am real sorry to make you any trouble, and much less Uncle Hiram, but this is a matter, if it can be properly done, which may be of considerable importance to me and several of my friends, and perhaps further the ends of justice.

There is one other mark which may aid you, which is—this man was in the rebel army, and *his forefinger on his left hand was shot off*. His nose is quite

prominent, and he has a very mild and quiet look, and he is the last man you would pick out for the scoundrel that he is. Yours very truly,

R. T. Bush.

P. S.—Please attend to it, and oblige.

Shortly after this letter reached its destination, Tecumseh, Mr. Bush received a telegram stating that the man had been found, and asking if they should arrest him. The correspondent had not observed the date of the letter, nor suspected that he was reading a novel; and in a few days the following letter was received:

Tecumseh, *April* 18, 1879.

Mr. R. T. Bush—

Dear Sir: Velina read to me a letter Wednesday evening from you, describing a certain man that was wanted in New York, who had recently left Toledo for this village.

The next morning, after hearing the description, I informed our marshal of the fact, and requested him to keep a lookout for such a man. In the course of half an hour he came to me, saying that he had just seen my man—with sandy whiskers, rather tall—would weigh 170 or 180 pounds—wearing specs, and the front finger of the left hand missing; and was very anxious that he should be immediately arrested, as he was then at the livery-stable, for a saddle-horse to ride away. I told him we had better wait and be sure that he was the one we wanted, and also find out if we could whether you wanted him arrested, should he prove to be the right man. I saw the man, and he answered the description so well, even to the *finger*, that I thought best to telegraph you for instructions. The Marshal, in the mean time, was to keep his eye on him (as he failed to get a horse). Seeing him walk down to dinner with one of our townsmen, the first opportunity he made some inquiries of this townsman, and found that he was not the man—that he was the cousin of this man that took him to dinner, and was brother to a Mrs. Palmer, whom he was visiting—that he lives in South Cleveland, Ohio, and is a lawyer by profession.

That he answered the description, both in size and the loss of the finger, as well as the color of his whiskers, there could be no doubt. Wearing specs we supposed was to hide the defects of that eye you mentioned, and he looked as though his side-whiskers had recently been cut or shaved; but if, as we were told, his home is in Cleveland, and his name is Hick, why of course we were deceived in the matter. And, if his friend has not informed him, he is still ignorant of our suspicions.

Now, as this is my first experience in the detective business, you will pardon the blunder.

Hoping that it has put you to no inconvenience, I remain yours, etc.,

H. Raymond.

The one striking feature of this coincidence is of course the *loss of the forefinger* in the *left* hand.

Both the imagined and the real case possessed this very exceptional peculiarity. This is a subject on which statistics can not be gained; but it is certain that in the whole continent not a small roomful could be found possessing precisely this deformity at the age specified; and

it may well be doubted whether in the whole world there is another person thus mutilated and at the same time possessing all the general physical characteristics of the individual described in the letter.

More striking still is the fact that this individual did not reside in the place where the letter was sent (which is not a large place), and was there by chance only the day that the letter reached there.

Those who believe that the mathematical doctrine of chances can solve the complex problems of coincidences will find in this case material for consideration. I may here quote a single sentence from the second of my series of papers on "Experiments with Living Human Beings," in the April number of the "Monthly": "In these and all studies of a like character it is to be recognized that coincidences of the most extraordinary character and astonishing nature are liable to occur at any instant, and that they are as likely to occur on the first trial as on the last of a long series."

A second point of great psychological interest in this case is the attempt made by the person to whom the letter was addressed to overlook certain discrepancies between the imaginary and real individual, and to twist and pervert and reason upon the facts of the case, so as to bring them into harmony with what he was *expecting to see*. While the man corresponded to the description in size, in the color of his whiskers, and especially in the loss of his finger, he did not correspond in the fact that he wore spectacles and had no side-whiskers. The detective reasoned that he wore spectacles to hide the defect in the eye, which defect he did not see; and he assumed, on thought, that the side-whiskers had been recently shaved or cut. Nothing is said of his stooping, or of his being lame in the left leg, or of the color of his hair, or of its length.

The bearings of this whole history on the delusions of clairvoyance mind-reading, animal magnetism, and spiritism are apparent. A successful coincidence of this kind would have made fortune and favor for any clairvoyant, or medium, or mind-reader.

Truly yours, GEORGE M. BEARD.

NEW YORK, *July*, 1879.

THE CLASSICAL CONTROVERSY.

BY PROFESSOR ALEXANDER BAIN.

ITS PRESENT ASPECT.

IN the present state of the controversy on classical studies, the publication of George Combe's contributions to Education is highly opportune. Combe took the lead in the attack on these studies fifty years ago, and Mr. Jolly, the editor of the volume, gives a connected view of the struggle that followed. The results were, on the whole,

not very great. A small portion of natural science was introduced into the secondary schools; but, as the classical teaching was kept up as before, the pupils were simply subjected to a greater crush of subjects; they could derive very little benefit from science introduced on such terms. The effect on the universities was *nil*. They were true to Dugald Stewart's celebrated deliverance on their conservatism.* The public, however, were not unmoved; during a number of years there was a most material reduction in the numbers attending all the Scotch universities, and the anti-classical agitation was reputed to be the cause.

The reasonings of Combe will still repay perusal. He puts with great felicity and clearness the standing objections to the classical system; while he is exceedingly liberal in his concessions, and moderate in his demands. "I do not denounce the ancient languages and classical literature on their own account, or desire to see them cast into utter oblivion. I admit them to be refined studies, and think that there are individuals who, having a natural turn for them, learn them easily and enjoy them much. They ought, therefore, to be cultivated by all such persons. My objection is solely to the practice of rendering them the main substance of the education bestowed on young men who have no taste or talent for them, and whose pursuits in life will not render them a valuable acquisition."

Before alluding to the more recent utterances in defense of classical teaching, I wish to lay out as distinctly as I can the various alternatives that are apparently now before us as respects the higher education—that is to say, the education begun in the secondary or grammar schools and completed and stamped in the universities:

1. The existing system of requiring proficiency in both classical languages. This requirement is imperative everywhere at present. The universities agree in exacting Latin and Greek as the condition of an Arts Degree, and in very little else. The defenders of classics say with some truth that these languages are the principal basis of uniformity in our degrees; if they were struck out, the public would not know what a degree meant.

How exclusive was the study of Latin and Greek in the schools in England, until lately, is too well known to need any detailed statement. A recent utterance of Mr. Gladstone, however, has felicitously supplied the crowning illustration. At Eton, in his time, the engrossment with classics was such as to keep out religious instruction!

As not many contend that Latin and Greek make an education in themselves, it is proper to call to mind what other things have been found possible to include with them in the scope of the Arts Degree.

* "The academical establishments of some parts of Europe are not without their use to the historian of the human mind. Immovably moored to the same station by the strength of their cables and the weight of their anchors, they enable him to measure the rapidity of the current by which the rest of the world is borne along."

The Scotch universities were always distinguished from the English in the breadth of their requirements; they have comprised for many ages three other subjects—mathematics, natural philosophy, and mental philosophy, including logic and ethics. In exceptional instances, another science is added; in one case, natural history, in another, chemistry. According to the notions of scientific order and completeness in the present day, a full course of the primary sciences would comprise mathematics, natural philosophy, chemistry, physiology or biology, and mental philosophy. The natural history branches are not looked upon as primary sciences; they give no laws, but repeat the laws of the primary sciences while classifying the kingdoms of nature.

In John Stuart Mill's celebrated address at St. Andrews, he stood up for the continuance of the classics in all their integrity, and suddenly became a great authority with numbers of persons who probably had never treated him as an authority before. But his advocacy of the classics was coupled with an equally strenuous advocacy for the extension of the scientific course to the full circle of the primary sciences; that is to say, he urged the addition of chemistry and physiology to the received sciences. Those that have so industriously brandished his authority for retaining classics, are discreetly silent upon this other recommendation. He was too little conversant with the working of universities to be aware that the addition of two sciences to the existing course was impracticable; and he was never asked which alternative he would prefer. I am inclined to believe that he would have sacrificed the classics to scientific completeness; he would have been satisfied with the quantum of these already gained at school. But, while we have no positive assurance on this point, I consider that his opinion should be wholly discounted as not bearing on the actual case.

The founders of the University of London attempted to realize Mill's conception to the full. They retained classics; they added English and a modern language, and completed the course of primary science by including chemistry and physiology. This was a noble experiment, and we can now report on its success. The classical languages, English and French or German, mathematics and natural philosophy, and (after a time) logic and moral philosophy, were all kept at a good standard; thus exceeding the requirements of the Scotch universities at the time by English and a modern language. The amount of attainment in chemistry was very small, and was disposed of in the matriculation examination. Physiology was reserved for the final B. A. examination, and was the least satisfactory of all. Having myself sat at the Examining Board while Dr. Sharpey was Examiner in Physiology, I had occasion to know that he considered it prudent to be content with a mere show of studying the subject. Thus, though the experience of the University of London, as well as

of the Scotch universities, proves that the classics are compatible with a very tolerable scientific education, they will need to be curtailed if every one of the fundamental sciences, as Mill urged, is to be represented at a passable figure.

In the various new proposals for extending the sphere of scientific knowledge, a much smaller amount of classics is to be required, but neither of the two languages is wholly dispensed with. If not taught at college, they must be taken up at school as a preparation for entering on the Arts curriculum in the university. This can hardly be a permanent state of things, but it is likely to be in operation for some time.

2. The remitting of Greek in favor of a modern language is the alternative most prominently before the public at present. It accepts the mixed form of the old curriculum, and replaces one of the dead languages by one of the living. Resisted by the whole might of the classical party, this proposal finds favor with the lay professions as giving one language that will actually be useful to the pupils as a language. It is the very smallest change that would be a real relief. That it will speedily be carried we do not doubt.

Except as a relaxation of the gripe of classicism, this change is not altogether satisfactory. That there must be two languages (besides English) in order to an Arts Degree is far from obvious. Moreover, although it is very desirable that every pupil should have facilities at school or college for commencing modern languages, these do not rank as indispensable and universal culture, like the knowledge of sciences and of literature generally. They would have to be taught along with their respective literatures to correspond to the classics.

Another objection to replacing classics by modern languages is the necessity of importing foreigners as teachers. Now, although there are plenty of Frenchmen and Germans that can teach as well as any Englishmen, it is a painful fact that foreigners do oftener miscarry, both in teaching and discipline, with English pupils, than our own countrymen. Foreign masters are well enough for those that go to them voluntarily with the desire of being taught; it is as teachers in a compulsory curriculum that their inferiority becomes apparent.

The retort is sometimes made to this proposal—Why omit Greek rather than Latin? Should you not retain the greater of the two languages? This may be pronounced as mainly a piece of tactics; for every one must know that the order of teaching Latin and Greek at the schools will never be topsy-turvied to suit the fancy of an individual here and there, even although John Stuart Mill himself was educated in that order. On the scheme of withdrawing all foreign languages from the imperative curriculum, and providing for them as voluntary adjuncts, such freedom of selection would be easy.

3. Another alternative is to remit both Latin and Greek in favor of French and German. Strange to say, this advance upon the previous alternative was actually contained in Mr. Gladstone's ill-fated

Irish University Bill. Had that bill succeeded, the Irish would have been for ten years in the enjoyment of a full option for both the languages.* From a careful perusal of the debates, I could not discover that the opposition ever fastened upon this bold surrender of the classical exclusiveness.

The proposal was facilitated by the existence of professors of French and German in the Queen's colleges. In the English and Scotch colleges endowments are not as yet provided for these languages; although it would be easy enough to make provision for them in Oxford and Cambridge.

In favor of this alternative, it is urged that the classics, if entered on at all, should be entered on thoroughly and entirely. The two languages and literatures form a coherent whole, an homogeneous discipline; and those that do not mean to follow this out should not begin it. Some of the upholders of classics take this view.

4. More thorough-going still is the scheme of complete bifurcation of the classical and the modern sides. In our great schools there has been instituted what is called the modern side, made up of sciences and modern languages, together with Latin. The understanding hitherto has been that the votaries of the ancient and classical side should alone proceed to the universities; the modern side being the introduction to commercial life, and to professions that dispense with a university degree. Here, as far as the schools are concerned, a fair scope is given to modern studies.

As was to be expected, the modern side is now demanding admission to the universities on its own terms; that is, to continue the same line of studies there, and to be crowned with the same distinctions as the classical side. This attempt to render school and college homogeneous throughout, to treat ancient studies and modern studies as of equal value in the eye of the law, will of course be resisted to the utmost. Yet it seems the only solution that can bring about a settlement that will last.

The defenders of the classical system in its extreme exclusiveness are fond of adducing examples of very illustrious men who at college showed an utter incapacity for science in its simplest elements. They say that by classics alone these men are what they are; and, if their way had been stopped by serious scientific requirements, they would have never come before the world at all. The allegation is somewhat strongly put; yet we shall assume it to be correct, on condition of being allowed to draw an inference. If some minds are so constituted for languages, and for classics in particular, may not there be other

* No doubt the classical languages would have been required, to some extent, in matriculating to enter college. This arrangement, however, as regarded the students that chose the modern languages, would have been found too burdensome by our Irish friends, and, on their expressing themselves to that effect, would have been soon dispensed with.

minds equally constituted for science, and equally incapable of taking up two classical languages? Should this be granted, the next question is, Ought these two classes of minds to be treated as equal in rights and privileges? The upholders of the present system say, No. The language-mind is the true aristocrat; the science-mind is an inferior creation. Degrees and privileges are for the man that can score languages, with never so little science; outer darkness is assigned to the man whose *forte* is science alone. But a war of caste in education is an unseemly thing; and, after all the leveling operations that we have passed through, it is not likely that this distinction will be long preserved.

The modern side, as at present constituted, still retains Latin. There is a considerable strength of feeling in favor of that language for all kinds of people; it is thought to be a proper appendage of the lay professions; and there is a widespread opinion in favor of its utility for English. So much is this the case, that the modern-siders are at present quite willing to come under a pledge to keep up Latin, and to pass in it with a view to the university. In fact, the schools find this for the present the most convenient arrangement. It is easier to supply teaching in Latin than in a modern language, or in most other things; and, while Latin continues to be held in respect, it will remain untouched. Yet the quantity of time occupied by it, with so little result, must ultimately force a departure from the present curriculum. The real destination of the modern side is to be modern throughout. It should not be rigorously tied down even to a certain number of modern languages. English and one other language ought to be quite enough; and the choice should be free. On this footing, the modern side ought to have its place in the schools as the coequal of classics; it would be the natural precursor of the modernized alternatives in the universities; those where knowledge subjects predominate.

The proposal to give an inferior degree to a curriculum that excludes Greek should, in my judgment, be simply declined. It is, however, a matter of opinion whether, in point of tactics, the modern party did not do well to accept this as an installment in the mean time. The Oxford offer, as I understand it, is so far liberal, that the new degree is to rank equal in privileges with the old, although inferior in *prestige*. In Scotland, the degree conceded by the classical party to a Greekless education was worthless, and was offered for that very reason.*

Among the adherents of classics, Professor Blackie is distinguished for surrendering their study in the case of those that can not profit by them. He believes that with a free alternative, such as the thorough bifurcation into two sides would give, they would still hold their

* One possible consequence of the new Natural Science Degree may be, that the public will turn to it with favor, while the old one sinks into discredit.

ground, and bear all their present fruits. His classical brethren, however, do not in general share this conviction. They seem to think that if they can no longer compel every university graduate to pass beneath the double yoke of Rome and Greece, these two illustrious nationalities will be in danger of passing out of the popular mind altogether. For my own part, I do not share their fears, nor do I think that, even on the voluntary footing, the study of the two languages will decline with any great rapidity. As I have said, the belief in Latin is wide and deep. Whatever may be urged as to the extraordinary stringency of the intellectual discipline now said to be given by means of Latin and Greek, I am satisfied that the feeling with both teachers and scholars is that the process of acquisition is not toilsome to either party; less so perhaps than anything that would come in their place. Of the hundreds of hours spent over them, a very large number are associated with listless idleness. Carlyle describes Scott's novels as a "beatific lubber-land"; with the exception of the "beatific," we might say nearly the same of classics. To all which must be added the immense endowments of classical teaching; not only of old date but of recent acquisition. It will be a very long time before these endowments can be diverted, even although the study decline steadily in estimation.

The thing that stands to reason is to place the modern and the ancient studies on exactly the same footing; to accord a fair field and no favor. The public will decide for themselves in the long run. If the classical advocates are afraid of this test, they have no faith in the merits of their own case.

The arguments *pro* and *con* on the question have been almost exhausted. Nothing is left except to vary the expression and illustration. Still, so long as the monopoly exists, it will be argued and counter-argued; and, if there are no new reasons, the old will have to be iterated.

Perhaps the most hackneyed of all the answers to the case for the classics is the one that has been most rarely replied to. I mean the fact that the Greeks were not acquainted with any language but their own. I have never known an attempt to parry this thrust. Yet, besides the fact itself, there are strong presumptions in favor of the position that, to know a language well, you should devote your time and strength to it alone, and not to attempt to learn three or four. Of course, the Greeks were in possession of language A 1, and were not likely to be gainers by studying the languages of their contemporaries. So we too are in possession of a very admirable language, although put together in a nondescript fashion; and it is not impossible that, if Plato had his "Dialogues" to compose among us, he would give his whole strength to working up our own resources, and not trouble himself with Greek. The popular dictum—*multum non multa*, doing one thing well—may be plausibly adduced in behalf of parsimony in the study of languages.

The recent agitation in Cambridge, in Oxford, and indeed all over the country, for remitting the study of Greek as an essential of the Arts Degree, has led to a reproduction of the usual defenses of things as they are. The articles in the March number of this "Review," by Professors Blackie and Bonamy Price, may claim to be the *derniers mots.*

Professor Blackie's article is a warning to the teachers of classics, to the effect that they must change their front; that, whereas the value of the classics as a key to thought has diminished, and is diminishing, they must by all means in the first place improve their drill. In fact, unless something can be done to lessen the labor of the acquisition by better teaching, and to secure the much-vaunted intellectual discipline of the languages, the battle will soon be lost. Accordingly, the Professor goes minutely into what he conceives the best methods of teaching. It is not my purpose to follow him in this sufficiently interesting discussion. I simply remark that he is staking the case for the continuance of Latin and Greek in the schools on the possibility of something like an entire revolution in the teaching art. Revolution is not too strong a word for what is proposed. The weak part of the new position is that the value of the languages *as languages* has declined, and has to be made up by the incident of their value as *drill.* This is, to say the least, a paradoxical position for a language-teacher. If it is mere drill that is wanted, a very small corner of one language would suffice. The teacher and the pupil alike are placed between the two stools—interpretation and drill. A new generation of teachers must arise to attain the dexterity requisite for the task.

Professor Blackie's concession is of no small importance in the actual situation. "No one is to receive a full degree without showing a fair proficiency in two foreign languages, one ancient and one modern, with free option." This would satisfy the present demand everywhere, and for some time to come.

The article of Professor Bonamy Price is conceived in even a higher strain than the other. There is so far a method of argumentation in it that the case is laid out under four distinct heads, but there is no decisive separation of reasons; many of the things said under one head might easily be transferred without the sense of dislocation to any other head. The writer indulges in high-flown rhetorical assertions rather than in specific facts and arguments. The first merit of classics is that "they are languages; not particular sciences, nor definite branches of knowledge, but literatures." Under this head we have such glowing sentences as these: "Think of the many elements of thought a boy comes in contact with when he reads Cæsar and Tacitus in succession, Herodotus and Homer, Thucydides and Aristotle! . . . See what is implied in having read Homer intelligently through, or Thucydides, or Demosthenes; what light will have been shed on the essence and laws of human existence, on political society, on the relations of man to man,

on human nature itself!" There are various conceivable ways of counter-arguing these assertions, but the shortest is to call for the facts—the results upon the many thousands that have passed through their ten years of classical drill. Professor Campbell, of St. Andrews, once remarked, with reference to the value of Greek in particular, that the question would have to be ultimately decided by the inner consciousness of those that have undergone the study. To this we are entitled to add, their powers as manifested to the world, of which powers spectators can be the judges. When, with a few brilliant exceptions, we discover nothing at all remarkable in the men that have been subjected to the classical training, we may consider it as almost a waste of time to analyze the grandiloquent assertions of Mr. Bonamy Price. But, if we were to analyze them, we should find that *boys* never read Cæsar and Tacitus through in succession; still less Thucydides, Demosthenes, and Aristotle; that very few *men* read and understand these writers; that the shortest way to come into contact with Aristotle is to avoid his Greek altogether, and take his expositors and translators in the modern languages.

The Professor is not insensible to the reproach that the vaunted classical education has been a failure, as compared with these splendid promises. He says, however, that, though many have failed to become classical scholars in the full sense of the word, "it does not follow that they have gained nothing from their study of Greek and Latin; just the contrary is the truth." The "contrary" must mean that they have gained something, which something is stated to be "the extent to which the faculties of the boy have been developed, the quantity of impalpable but not less real attainments he has achieved, and his general readiness for life, and for action as a man." But it is becoming more and more difficult to induce people to spend a long course of youthful years upon a confessedly *impalpable* result. We might give up a few months to a speculative and doubtful good, but we need palpable consequences to show for our years spent on classics. Next comes the admission that the teaching is often bad. But why should the teaching be so bad, and what is the hope of making it better? Then we are told that science by itself leaves the largest and most important portion of the youth's nature absolutely undeveloped. But, in the first place, it is not proposed to reduce the school and college curriculum to science alone; and, in the next place, who can say what are the "impalpable" results of science?

The second branch of the argument relates to the greatness of the classical writers. Undoubtedly there are some very great writers in the Greek and Roman world, and some that are not great. But the greatness of Herodotus, Thucydides, Demosthenes, Plato, and Aristotle can be exhibited in a modern rendering; while no small portion of the poetical form can be made apparent without toiling at the original tongues. The value of the languages, then, resolves itself, as

has been often said, into a *residuum*. Something also is to be said for the greatness of the writers that have written in modern times. Sir John Herschel remarked long ago that the human intellect can not have degenerated, so long as we are able to quote Newton, Lagrange, and Laplace, against Aristotle and Archimedes. I would not undertake to say that any modern mind has equaled Aristotle in the *range* of his intellectual powers; but, in point of intensity of grasp in any one subject, he has many rivals; so that, to obtain his equal, we have only to take two or three first-rate moderns.

If a number of persons were to go on lauding to the skies the exclusive and transcendent greatness of the classical writers, we should probably be tempted to scrutinize their merits more severely than is usual. Many things could be said against their sufficiency as instructors in matters of thought, and many more against the low and barbarous tone of their *morale;* the inhumanity and brutality of both their principles and their practice. All this might no doubt be very easily overdone, and would certainly be so if undertaken in the style of Professor Price's panegyric.

The Professor's third branch of the argument comes to the real point; namely, what is there in Greek and Latin that there is not in the modern tongues? For one thing, says the Professor, they are dead, which, of course, we allow. Then, being dead, they must be learned by book and by rule; they can not be learned by ear. Here, however, Professor Blackie would dissent, and would say that the great improvement of teaching, on which the salvation of classical study now hangs, is to make it a teaching by the ear. But, says Professor Price, "a Greek or Latin sentence is a nut with a strong shell concealing the kernel—a puzzle, demanding reflection, adaptation of means to end, and labor for its solution, and the educational value resides in the shell and in the puzzle." As this strain of remark is not new, there is nothing new to be said in answer to it. Such puzzling efforts are certainly not the rule in learning Latin and Greek. Moreover, the very same terms would describe what may happen equally often in reading difficult authors in French, German, or Italian. Would not the pupil find puzzles and difficulties in Dante or in Goethe? And are there not many puzzling exercises in deciphering English authors? Besides, what is the great objection to science, but that it is too puzzling for minds that are quite competent for the puzzles of Greek and Latin. Once more, the *teaching* of any language must be very imperfect, if it brought about habitually such situations of difficulty as are here described.

The Professor relapses into a cooler and correcter strain when he remarks that the pupil's mind is necessarily more delayed over the expression of a thought in a foreign language (whether dead or alive matters not), and therefore remembers the meaning better. Here, however, the desiderated reform of teaching might come into play.

Granted that the boy left to himself would go more rapidly through Burke than through Thucydides, might not his pace be arrested by a well-directed cross-examination; with this advantage, that the length of attention might be graduated according to the importance of the subject, and not according to the accidental difficulty of the language?

The Professor boldly grapples with the alleged waste of time in classics, and urges that "the gain may be measured by the time expended," which is very like begging the question.

One advantage adduced under this head deserves notice. The languages being dead, as well as all the societies and interests that they represent, they do not excite the prejudices and the passions of modern life. This, however, may need some qualification. Grote wrote his history of Greece to counterwork the party bias of Mitford. The battles of despotism, oligarchy, and democracy are to this hour fought over the dead bodies of Greece and Rome. If the Professor meant to insinuate that those that have gone through the classical training are less violent as partisans, more dispassionate in political judgments, than the rest of mankind, we can only say that we should not have known this from our actual experience. The discovery of some sweet, oblivious antidote to party feeling seems, as far as we can judge, to be still in the future. If we want studies that will, while they last, thoroughly divert the mind from the prejudices of party, science is even better than ancient history; there are no party cries connected with the Binomial Theorem.

The Professor's last branch of argument, I am obliged with all deference to say, contains no argument at all. It is that, in classical education, a close contact is established between the mind of the boy and the mind of the master. He does not even attempt to show how the effect is peculiar to classical teaching. The whole of this part of the paper is, in fact, addressed, by way of remonstrance, to the writer's own friends, the classical teachers. He reproaches them for their inefficiency, for their not being Arnolds. It is not my business to interfere between him and them in this matter. So much stress does he lay upon the teacher's part in the work, that I almost expected the admission that a good teacher in English, German, natural history, political economy, might even be preferable to a bad teacher of Latin and Greek.

The recent Oxford contest has brought out the eminent oratorical powers of Canon Liddon; and we have some curiosity in noting his contributions to the classical side. I refer to his letter in the "Times." The gist of his advocacy of Greek is contained in the following allegations: First, the present system enables a man to recur with profit and advantage to Greek literature. To this it has been often replied, that by far the greater number are too little familiarized with the

classical languages, and especially Greek, to make the literature easy reading. But further, the recurring to the study of ancient authors, by busy professional men in the present day, is an event of such extreme rarity that it can not be taken into account in any question of public policy. The second remark is, that the half-knowledge of the ordinary graduate is a link between the total blank of the outer world and the thorough knowledge of the accomplished classic. I am not much struck by the force of this argument. I think that the classical scholar might, by expositions, commentaries, and translations, address the outer world equally well, without the intervening mass of imperfect scholars. Lastly, the Canon puts in a claim for his own cloth. The knowledge of Greek paves the way for serious men to enter the ministry in middle life. Argument would be thrown away upon any one that could for a moment entertain this as a sufficient reason for compelling every graduate in arts to study Greek. The observation that I would make upon it has a wider bearing. Middle life is not too late for learning any language that we suddenly discover to be a want; the stimulus of necessity or of strong interest and the wider compass of general knowledge compensate for the diminution of verbal memory.—*Contemporary Review.*

THE VANILLA-PLANT.*

By J. POISSON,

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OF all orchids the vanilla is the one most widely known; its fruit is deservedly esteemed and is an important article of commerce. Its valuable properties long ago brought the vanilla into notice. The fruit appears to have been first introduced into Europe in the beginning of the sixteenth century. The living plant was imported into England, toward the end of the eighteenth century, by Miller; but we can not with certainty determine which one of the few species of vanilla now known was then introduced. Linné, however, gave the name *Epidendrum vanilla* to the plant which had come into his hands, and which is supposed to have been identical with that brought by Miller. Several years later Swartz, on attentively studying the flower of the vanilla, observed notable differences between it and the flower of the genus *Epidendrum;* he was thus led to constitute a new genus, and *Epidendrum vanilla* now became *Vanilla aromatica.* Later Greville brought from America some cuttings of a vanilla differing from *Vanilla aromatica,* especially in the size of the leaves; to this Andrews gave the name *Vanilla planifolia.* This plant was

* Translated from "La Nature" by J. Fitzgerald, A. M.

brought first to England, thence to the Museum at Paris in 1810, and lastly to Belgium; it is the species whose fruit possesses the strongest perfume.

The vanilla throve in greenhouses, but as it was sensitive to cold, and did not fructify, and its flowers possessed no ornamental interest, its culture was very limited. For a long time the only fruits which came to Europe were from Mexico, or the Gulf of Mexico—the only points where the plant was cultivated on a large scale, and where its fructification appeared to be insured. It remained for later experimenters to add to the interest attaching to this plant, while at the same time, in some degree, augmenting the resources of the colonies.

At this time the impression made by certain recent researches on fecundation in plants was still fresh, and the questions of hybridation and crossing were closely studied.

It has ever since been believed that the fecundation of the vanilla in Mexico and the neighboring countries, where that plant fructifies normally, was brought about by the agency of certain insects which hitherto do not appear ever to have been observed performing this function. The hypothesis is almost equivalent to a certainty, now that we know the habits of the *Orchideæ*, especially as regards reproduction.

VANILLA PLANIFOLIA.

The right of priority in discovering the artificial fecundation of the vanilla has been claimed for many countries. It belongs to England, say those who dwell on the other side of the Channel; but, if we are to believe the Belgians, the true discoverer was Charles Morren. Nevertheless it appears indisputable that Neumann, head-gardener at the Paris Museum of Natural History, was the first to obtain the results of this fructification in 1830. From a single stock Neumann produced, in that year, over two hundred vanilla fruits of excellent quality.

M. Delteil, pharmacist in the navy, in his interesting study of the vanilla ("Étude sur la Vanille," 1874), gives a list of the works which have been published concerning this plant, and treats of its culture in Réunion Island particularly. He states that in 1839 Perrottet, on his second voyage to Bourbon, made known to some of his friends among the planters the process adopted by Neumann; for, though the vanilla was cultivated as a curiosity, it did not bear fruit there any more than in Europe. Nothing appears to have come out of this suggestion; but the case was different with the discovery made about the same time

by a young slave, Edmond Albius, in the service of M. Ferréol Beaumont-Bellier. Albius had noticed how his master, who had considerable acquaintance with natural history, used to produce hybrids by cross-fertilization of the various flowers in his garden. Having made like experiments himself, the young slave observed that, on touching with a spine of palm the flowers of the vanilla, two little yellow bodies contained within changed position, and that fructification resulted from the contact. A new branch of commerce was henceforth created, and vanilla-beans, previously very dear, were quickly much lowered in price.

The vanilla is a climbing plant with pulpy stem, but it can reach the tops of high trees. In our greenhouses it attains proportions sufficiently great to enable us to judge of its appearance. Its stem, which can be easily made to ramify, is from two to three centimetres in diameter. Its leaves are arranged in two rows, or are alternately distichous, as the botanists say. In size they vary from fifteen to twenty centimetres, and they are slightly twisted on their short petiole, so as to appear to be inserted obliquely. This torsion seems to be produced by the need for the leaf of having its upper face always turned toward the light.

Besides the roots at the base of the plant and fixed in the soil, a multitude of adventitious aërial roots start from the stem or the branches, after the plant has reached a certain size. These roots hang free so long as the stem rises vertically, but become fixed in the soil when the stem touches the ground. They start from the level of a leaf alongside of a tendril, with the aid of which the plant climbs trees.

The stem, which in the interval between two leaves takes a direction the reverse of that taken in the next interval—a zigzag—is charged with a thick, vesicating juice, which on being applied to the skin produces a blister.

The flowers appear in clusters at the axils of the leaves, and are numerous; but care is taken to leave only a small number of them on the plant when it is desired to have fine fruit. These flowers last for only one day, and fructification, in order to be successful, should take place in the morning. The instrument used for this operation is a pointed piece of bamboo. A skilled man can fecundate as many as one thousand flowers in a morning. One month after fecundation the fruit has attained its full size, yet it has still to remain on the plant six or seven months more before it reaches perfect maturity.

The flowers of the vanilla have none of that richness of color so common among orchids. They are whitish or yellowish, according to the species to which they belong. Apart from those which are cultivated on account of the perfume of their fruit, the others possess only a purely botanical interest.

A physiological detail that is worthy of mention is the attraction of the stigmas of these flowers for the pollen offered to them. Neumann the younger had frequent occasion to notice this while experi-

menting on the fecundation of the vanilla at the Museum; and in a prize essay by H. Baillon the same fact is confirmed. "When the sky was overcast," he writes, "and the temperature rather low, I had to penetrate into the stigmatic antrum, in order there to place the little pollen apparatus; but, after the sun had made pretty warm the greenhouse in which the plant was suspended, then, provided the contents of the anther were not firmly attached to the top of the pins on which they were borne, they would become detached from it on being brought within a certain distance from the stigma, and, being strongly attracted, would shoot like an arrow into the cavity." This curious observation appears to be without precedent save in this plant; it is certainly of a character to interest the physiologist.

Darwin has observed a strange movement of the pollinia in the flowers of *Catasetum*, which, under the influence of innervation, "were shot forth to the distance of two or three feet"; but here the phenomenon is purely mechanical.

The first travelers who observed the vanilla in the wild state have asserted that it grows in low, moist situations near the seacoast; but in later times it has been found in the forests, and is known to occur in divers parts in Central America.

The number of species of the vanilla-plant is not clearly determined. Of types cultivated in Mexico there are twelve, and of these five are reckoned as distinct species. One of these species, the *Vanilla lec*, embraces six varieties. Delteil gives a list of species cultivated in different countries; it is as follows: In Mexico, *Vanilla sativa*, *V. silvestris*, *V. planifolia*, and *V. pompona;* in Guiana, *V. guianensis*, with yellow flowers and large fruit; at Bahia, *V. palmarum;* in Brazil and Peru, Linné's *V. aromatica*, which possesses less fragrance than the others. In Réunion two sorts are cultivated, both of them apparently varieties of *V. planifolia.*

Under the title of *vanillon* is found in commerce a short, thick vanilla-pod, produced by *V. pompona*, the fruit of which is of far less value than that of the *V. planifolia.*

Now that the cultivation of vanilla is widely extended, the fine quality of beans can be had at from one hundred and eighty to two hundred and fifty francs per kilogramme. But when it is "frosted," i. e., covered with needles of vanillin, it may fetch a higher price. Vanillon is worth about one fourth as much as vanilla.

Vanilla plantations, to be profitable, require great and constant care. The plants are multiplied by cuttings. The cuttings should bear three or four leaves, and may be a metre or over in length. Rainy and hot seasons are chosen by preference for planting. The cuttings must be planted in rows apart, in a soil rich in vegetable molds fertilized with the decaying leaves and branches of plants, especially of the banana. Each cutting should have a prop, and the ground at its root is to be kept moist by a heap of stones around the stem.

The best practice in these plantations is to train the plants on espaliers reaching from one prop to another. Generally the props are themselves plant-cuttings, which bear leaves and so shelter the young plants from the excessive heat of the sun. In case the props are of dead timber, the shrubs which are to afford shade must be planted in the intervals between the vanilla-plants. In addition to these means of shelter the plantation must be surrounded with a hedge of shrubbery for the sake of breaking the force of the winds.

Experience has shown that a vanilla plantation should not be worked for over seven years; but in the mean time a new one is got in readiness, so that there may be no interruption.

The vanilla harvest in Réunion occurs from May to August; in Mexico it takes place in December. The fruits, improperly called pods, are best when they have had good exposure to the sun, are fully mature, but not open, and gathered in a hot, dry season.

The modes of preparation differ according to locality, but in general they may be classed under three heads. The oldest method is that of alternately exposing the fruits to the sun and then keeping them in shade till they are sufficiently dry. This is the practice in Mexico and Guiana, where vanilla of excellent quality is produced. Sometimes they are exposed to the action of artificial heat to hasten the drying. Another mode consists in employing boiling water, in which the fruit is dipped for a while, and then treated with sunlight and shade as above. Finally, the third method consists in employing an oven at the temperature of 50° to 75° Cent.; in this the beans are heated from twenty-four to thirty-six hours. Among the many processes, M. Delteil appears to give the preference to that in use in Réunion, i. e., that which employs boiling water, together with the subsequent treatment. Excellent results are also obtained by spreading the fruit on black cloths and exposing them to the heat of the sun.

Finally, the fruit is sent to the drying-room. Here it remains for about a month, being looked after from time to time. The vanilla is then packed in tin cases to prevent its becoming too dry, which would impair its value.

CHLORAL AND OTHER NARCOTICS.

By Dr. BENJAMIN W. RICHARDSON, F.R.S.

II.

IT may be interesting at this point to particularize the character of the influence exercised on life by certain of the agents we have now under consideration. With the action of alcohol and tobacco we are all so familiar it is not necessary to repeat what is known of them as

members of the toxical family of luxury. Let me rather devote a few pages to the consideration of two or three of the less commonly used agents, with the dangers of which the public mind is not so strongly impressed, and with the facts of which it is not so conversant. I will take three of these as the most important at the present time—namely, chloral hydrate, opium, and absinthe.

The serious truth that chloral hydrate after its introduction into medicine was soon made use of as a toxical luxury has already been adverted to. At the meeting of the British Association for the Advancement of Science, held in Edinburgh in the year 1871, I drew earnest attention to this subject. I said—and the words were published in the report of that year (page 147)—"There is another subject of public interest connected with the employment of chloral hydrate. I refer to the increasing habitual use of it as a narcotic. As there are alcoholic intemperants and opium-eaters, so now there are those who, beginning to take chloral hydrate to relieve pain or to procure sleep, get into the fixed habit of taking it several times daily and in full doses. I would state from this public place as earnestly and as forcibly as I can that this growing practice is alike injurious to the mental, the moral, and the purely physical life, and that the confirmed habit of taking chloral hydrate leads to inevitable and confirmed disease. Under it the digestion gets impaired; natural tendency to sleep and natural sleep is impaired; the blood is changed in quality, its plastic properties and its capacity for oxidation being reduced; the secretions are depraved, and, the nervous system losing its regulating, controlling power, the muscles become unsteady, the heart irregular and intermittent, and the mind excited, uncertain, and unstable. To crown the mischief, in not a few cases already the habitual dose has been the last, involuntary or rather unintentional suicide closing the scene. I press these facts on public attention not one moment too soon, and I add to them the further facts that hydrate of chloral is purely and absolutely a medicine, and that, whenever its administration is not guided by medical science and experience, it ceases to be a boon, and becomes a curse to mankind."

This was stated within two years after the substance chloral hydrate came into medical use. If at that time the mind of the public had been as ripe as it is now for the acceptance of the truth, or if I could then have reached the ear of the public more plainly, much evil might have been nipped in the bud. As it was, the warning had little effect, except to expose me to adverse criticism as an alarmist, and the evil has gone on with increasing rapidity and mischief. There is at the present time a considerable community addicted to the habitual use of chloral hydrate on one pretense or another, and a learned medical society has recently framed a series of written questions on the subject, which questions it has felt it expedient to address to members of the profession of medicine generally for their replies.

The persons who become habituated to chloral hydrate are of two or three classes as a rule. Some have originally taken the narcotic to relieve pain, using it in the earliest application of it for a true medicinal and legitimate object, probably under medical direction. Finding that it gave relief and repose, they have continued the use of it, and at last have got so abnormally under its influence that they can not get to sleep if they fail to resort to it. A second class of persons who take to chloral are alcoholic inebriates who have arrived at that stage of alcoholism when sleep is always disturbed, and often nearly impossible. These persons at first wake many times in the night with coldness of the lower limbs, cold sweatings, startings, and restless dreamings. In a little time they become nervous about submitting themselves to sleep, and before long habituate themselves to watchfulness and restlessness, until a confirmed insomnia is the result. Worn out with sleeplessness, and failing to find any relief that is satisfactory or safe in their false friend alcohol, they turn to chloral, and in it find for a season the oblivion which they desire, and which they call rest. It is a kind of rest, and is no doubt better than no rest at all; but it leads to the unhealthy states that we are now conversant with, and it rather promotes than destroys the craving for alcohol. In short, the man who takes to chloral after alcohol enlists two cravings for a single craving, and is double-shotted in the worst sense. A third class of men who become habituated to the use of chloral are men of extremely nervous and excitable temperament, who by nature, and often by the labors in which they are occupied, become bad sleepers. A little thing in the course of their daily routine oppresses them. What to other men is passing annoyance, thrown off with the next step, is to these men a worry and anxiety of hours. They are over-susceptible of what is said of them, and of their work, however good the work may be. They are too elated when praised, and too depressed when not praised, or dispraised. They fail to play character-parts on the stage of this world, and as they lie down to rest they take all their cares and anxieties into bed with them, in the liveliest state of perturbation. Unable in this condition to sleep, and not knowing a more natural remedy, they resort to the use of such an instrument as chloral hydrate. They begin with a moderate dose; increase the dose as occasion seems to demand, and at last, in what they consider a safe and moderate system of employing it, they depend on the narcotic for their falsified repose.

Among these classes of men the use of chloral hydrate is on the increase. The use is essentially a bad business at the best, and while I do not wish in the least to exaggerate the danger springing from it —while, indeed, I am willing to state that I have never been able to trace out a series of fatal organic changes of a structural character from such use—I have certainly seen a great deal of temporary disturbance and enfeeblement from it, without any corresponding advan-

tage that might be set forth as an exchange of some good for some harm. The conclusion I have been forced to arrive at is in brief to this effect: that if chloral hydrate can not be kept for use within its legitimate sphere as a medicine, to be prescribed by the physician according to his judgment, and by him as rarely as is possible, it were better for mankind not to have it at any price.

I expressed an opinion in 1876 that the use of opium, as a toxical agent to which persons habituate themselves, is dying out in this country. I see no reason to modify that view now. I am quite sure that among the better classes the practice of taking opium is less common than it was formerly, and I believe that chloral hydrate has more than usurped its place. The idea, gathered from one or two local practices, which, like a fashion, come and go, that opium-eating is on the increase among the poorer members of society, is, I believe, equally fallacious. I can discover no warranty for any such a general and sweeping assumption. As to the assertion that those who are by their pledge removed from the use of alcoholic drinks, who are professed abstainers, are more addicted to opium-eating than alcoholic drinkers, the idea is too absurd, and can only have been suggested for the sake of the mischief that might follow a promulgation of the notion that, because one devil is cast out of a man, another must enter that is worse than the first. The facts really tell all the other way. The facts in the main are that those men and women who from principle abstain from one form of intoxicant most resolutely abjure all forms; and that those who indulge in one form are more apt than the rest to indulge in more than one. In the course of my career I have met with some persons of English society who have indulged in the use of opium; but I have never met one such who did not also take wine or some other kind of alcoholic drink. Putting the matter in another way, I can solemnly say that in the whole of my intercourse with the abstaining community—and few men indeed have been thrown more into contact with that community—I have never met with an instance that afforded so much as a suspicion of the practice of indulging in narcotism from opium, or any other similar drug. I have never yet met with an abstainer who was even habituated to the use of chloral hydrate. A few abstainers smoke tobacco, but, as the habit seriously taxes their physical health, most of them in due time forego even the luxury of the weed so soon as they discover its injuriousness.

The actual opium-eaters of modern society, who form a natural part of the nation as English people, are extremely limited in number, so limited that the mortality returns give no clew to them as a class suffering from the indulgence. I know not either of any physician or pathologist who has made a study of the organic changes induced in the bodies of natives of these islands who have died from the effects of opium. Still there are a few who indulge; and I fear that among the children of the poor, the infant children, the use of narcotics con-

taining opium is an abused, much-abused system. The adults who indulge are, according to my experience, of three classes: There are some who in the course of disease attended with long-continued acute pain, like neuralgia pain, have found relief from opium, and who having so become habituated to its use keep up the habit sometimes because they feel that they can not sleep without the drug, and sometimes because they have learned to experience a real luxury from its use. There is a limited section that has learned the practice of swallowing or of smoking opium from some Eastern association, and is professed in the practice in a certain moderate degree. Lastly, there are a few doubtless among the poorest of the community, who in some particular localities learn to partake of the narcotic, often not being aware of its true nature, and obtaining it under some fanciful name which has no direct reference to the narcotic itself.

To the few who in these classes may be called opium-eaters might be added a small number of alcoholic inebriates who partake of an opiate occasionally with their spirituous potations.

To whichever class they who habitually resort to opium may belong, they pay dearly for their temporary pleasure. They are a miserable set in mind as in body. They are preserved, as it were, in misery; they do not suffer acute diseases from their enemy, as the alcoholics do, by which their lives are abruptly cut short, but they continue depressed in mind, feeble and emaciated in body, and incapable of any long-continued effort. De Quincey, in language somewhat figurative and poetical, has described the class with a force, and on the whole a correctness, which may be accepted as a faithful record.

I can not report even so favorably on the use of absinthe as I have reported above on the use of opium. There can not, I fear, be a doubt that in large and closely packed towns and cities the consumption of absinthe is on the increase. In London it is decidedly on the increase. It is not possible to find a street in some parts of the metropolis in which the word "absinthe" does not meet the eye in the windows of houses devoted to the sale of other intoxicating and lethal drinks. Much of this advertisement of an unusually dangerous poison is made from ignorance of its nature as much as from cupidity. The suggestion for offering absinthe is that it is an agreeable bitter, that it gives an appetite, and that it gives tone to weak digestions. It is proffered much in the same manner as gin and bitters, and as in some private houses sherry and bitters are proffered. If you ask a seller of absinthe what he vends it for, he tells you, "As a tonic to help digestion."

There is no more terrible mistake than this statement. Absinthe as it is made in France, whence it is imported, is a mixture of essence of wormwood (*absinthium*), sweet-flag, anise-seed, angelica-root, and alcohol. It is colored green with the leaves or the juice of smallage,

spinach, or nettles. It is commonly adulterated. M. Derheims found it adulterated with sulphate of copper, blue vitriol, which substance is added in order to give the required greenish color or tint, as well as to afford a slight causticity, which to depraved tastes is considered the right thing to taste and swallow. M. Stanislas Martin stated that he found chloride of antimony, commonly called butter of antimony, as another adulteration used also to give the color. Chevalier doubts this latter adulteration, but the adulteration with the sulphate of copper is not disputed. The proportion of essence of wormwood to the alcohol is five drachms of the essence to one hundred quarts of alcohol. The action of absinthe on those who become habituated to its use is most deleterious. The bitterness increases the craving or desire, and the confirmed *habitué* is soon unable to take food until he is duly primed for it by the deadly provocative. On the nervous system the influence of the absinthium essence is different from the action of the alcohol. The absinthium acts rather after the manner of nicotine; but it is slower in taking effect than the alcohol which accompanies it into the organism. There is therefore felt by the drinker first the exciting relaxing influence of the alcohol, and afterward the constringing suppressing influence of the secondary and more slowly acting poison. The sufferer, for he must be so called, is left cold, tremulous, unsteady of movement, and nauseated. If his dose be large, these phenomena are exaggerated, and the voluntary muscles, bereft of the control of the will, are thrown into epileptiform convulsions, attended with unconsciousness and with an oblivion to all surrounding objects which I have known to last for six or seven hours. In the worst examples of poisoning from absinthe the person becomes a confirmed epileptic.

In addition to these general indications of evil there are certain local indications not less severe, not less dangerous. The effect which the absinthe exerts in a direct way on the stomach would alone be sufficiently pernicious. It controls for mischief the natural power of the stomach to secrete healthy digestive fluid. It interferes with the solvent power of that fluid itself, so that taken in what is considered to be a moderate quantity, one or two wineglassfuls in the course of the day, it soon establishes in the victim subjected to it a permanent dyspepsia. The appetite is so perverted that all desire for food is quenched until the desire is feebly whipped up by another draught of the destroyer. In a word, a more consummate devil of destruction could not be concocted by the finest skill of science devoted to the worst of purposes than is concocted in this destructive agent, absinthe. It is doubly lethal, and ought to be put down peremptorily in all places where it is sold. Our magistrates have full power to deal with this poison, if they had the discretion and the courage to use their power. They could prohibit the license to all who sell the poison. Beyond this, there is another power that ought to come into play.

Absinthe should be under the control of the Sale of Poisons Act, and no person ought to be able to get it in any form at all without signing a book and going through all the necessary formality for the purchase of a poison. To move the country to a due regard for its own interests as well as for the interests of the ignorant and deluded toxico-maniacs who indulge in absinthe, is the duty of all honest and truthful men.

It is my business in the remaining part of this communication to deal with a question which springs out of the practice of using lethal agents, and with which the minds of the thinking community are sorely exercised. The question I refer to is—Whether the use of these agents springs from a natural desire on the part of man, and of animals lower than man, for such agents; or whether it springs from a perversion or unnatural provocation acquired and transmitted in hereditary line, a toxico-mania, in plain and decisive language.

In respect to the idea that these agents are demanded by living animals as necessities of their transitory existence and residence on this earth, it must be obvious that the argument, as so stated, is based on the desire which has been impressed on the mind of the reasoners by the agents themselves. It is quite certain that men, and all the lower animals, can live without the supposed aid afforded by these substances, and that when they are not known life goes on smoothly and happily enough in their absence. They therefore are only pleaded for when they have made themselves felt, which looks strangely like an artificial pleading for an artificial as apart from a natural thing. Children do not plead for them; men who have been educated without them do not plead for them; animals do not beg for them; none ask for them until by education they have learned to use them. At first all rebel at them, and only after a fiery trial, during which they get over repugnance, acquire a liking to them, after which the liking may run into desire, and desire into infatuation.

Again, if these agents were natural for the wants of man and animal, they would not reasonably be expected to be left so far away, as they are left, from the immediate reach and possession of man and animal. To secure them for man and animal they have to be produced; to produce them, requires human ingenuity and skill, knowledge, science, and in some cases, as in the case of alcohol and alcoholic beverages, a very considerable degree of skill and an enormous amount of skilled labor. It is true that two of these substances, absinthium and opium, lie nearer at hand than the others, might be gathered and utilized by men in their savage state, and might be plucked and eaten even by beasts of the field. But the fact really seems to be that these very simples have not come into the possession of man for the service of the human family until by art the educated of the human race have learned the mode of use; while the lower animals, instead of instinctively finding them out and claiming the advantages which come from

them, have instinctively avoided them with an instigation of common sense that might happily have been imitated by their superiors in wisdom and intelligence.

Moreover, it has generally turned out that all which is required by man as a necessity for his existence has been in the most signal manner provided for him. He is a water-engine, so water is ready at his command; he is a muscular-engine, so muscle-forming substance is at his instant command; he is a passive skeleton, so the materials for the skeleton are at his ready command; he is a receptive organism through his nervous organization, so everything that is wanted for that system is ready prepared. He requires light to bring him into visible communion with the external world, and ere he existed the sun was ready to give him light and to quicken him with heat and motion. He requires sound, and there is the prepared atmosphere ready to vibrate in obedience to his voice. These were all pre-prepared for the man and his life. Is it possible that something more was wanting that he, in course of ages, had to discover? Suppose, like the lower animals, he had failed to discover, what then had been his fate?

To my mind—and I wish to be as open to conviction on this point as any one can be—I fail to discern a single opening for the use of these lethal agents in the service of mankind save in the most exceptional conditions of disease, and then only under skilled and thoughtful supervision, from hands that know the danger of infusing a false movement and life into so exquisite an organism as a living, breathing, pulsating, impressionable human form.

In the argument that these lethal agents are necessities, instinctively selected and chosen to meet human wants, there is no logical sequence. It is all confusion, assumption, apology for human weakness, exaltation of human weakness, sanction of temporary and doubtful pleasure, compromise with evil, and acceptance of penalties the direst, for advantages the poorest and least satisfactory. But when we turn to the other argument—when we reason that these lethal agents induce a physical and mental aberration which they afterward maintain—when we but whisper the word toxico-mania, as the exposition of their influence, all is clear enough. We leave the purely natural world of life to enter the aberrant world, and all there is as it would be to eyes from which the scales of superstition have fallen. These agents play no part in natural function or construction, but add a part which is obviously an aberration. If into a steady-going locomotive-engine the engineer infused some gallons of brandy, he would do something that would be conspicuous enough, but he would not thereby play a natural part in the working of that engine. He would only add a part which would be an aberration. There might be more rapid pulsation and motion for a brief period truly, but the pressure would be unequal, the working-gear unsteady, and by much repetition of the same act there might be accident, apoplexy, stroke, even in an engine, and there cer-

tainly would be a wearing-out which would lead to a limited future. So with the body under these lethal spells; we may add a part, or we may take a part away, but we can not by them maintain the uniform and natural law of life.

These agents create a desire, a craving for themselves, a new automatic expression, a new sense of necessity which did not preëxist, and which never exists until it is acquired. This seems to me the most perfect evidence of aberration. Whoever craves for anything is aberrant, and much craving for one thing is the most certain sign of a mad mind. We all admit this truth when the craving becomes insatiable; but between the smallest persistent craving and the most lamentable insatiate there is nothing more than degree; the fact is the same, and the movement along the line from the moderate toward the insatiate is commonly too easy and continuous. Craving for purely natural things in the midst of them is an unknown phenomenon in healthy men. Craving for unnatural things in the midst of them is well known; but is that healthy? The sane man who wants water asks for it; the sane animal that wants water seeks for it; the aberrant man clutches wine; the aberrant animal, rendered aberrant by the acquired craving, grows furious. No man drinks wine as he drinks water; there is a furor in the drinking of wine which marks a phenomenal disturbance, and which is distinct from the simple act of drinking from necessity, in the act as well as in the object.

The establishment of the craving or desire for these lethal agents in one living body is the frequent origin of the same desire in bodies that are to be. The craving is thus sometimes begotten of a craving, like other hereditary taints which lead to physical and mental errors and diseases, a specific indication of aberration from the natural health into disease, depending on hereditary constitutional tendency, and singularly indicative of original departure from the natural life. A still more striking illustration of the position I am now supporting is afforded in another action of these agents. The tendency of their action is, as a rule, toward premature physical death: the tendency is also toward premature mental death. A sudden excess of indulgence by any one of them, save perhaps arsenic, is all but certain to lead to some form of acute mental derangement or stupor, more or less decisive and prolonged. A gradual excessive indulgence is almost as certain to lead to a confirmed condition of aberration more or less determinate. If we watch carefully the career of a man who is passing through the course of an alcoholic intoxication, and if, after analyzing each phase of that progress, we pass into a lunatic asylum and look at the various phases of insanity exhibited in the persons of the different inmates who are there confined, there is no difficulty in finding represented, through certain of those unfortunates, all the shades of mental aberration which have previously been exhibited by the single person in the course of his rapid career from sanity into insanity and into

helpless paralysis. The wonder suggested, by such analysis of natural phenomena, is not that forty per cent. of the insanity of the country should be directly or indirectly produced by one lethal agent alone, but that so low a figure should indicate all the truth.

When, then, we fairly consider the two questions now before us—whether the lethal agents are called for because they are demanded by a law of natural necessity, a law which stands above man, and is dominant over his nature because independent of him; or whether there is no such law whatever, but an error of man himself, by which he institutes for himself a taste for lethal derangement, and, making for himself and his heirs a new constitution, begins thereupon to justify what he has done on the basis of the constitution he has established—when, I repeat, we consider these two questions, we can, I think, come but to one conclusion. We must, if prejudice be not too strong, lean to the view that man makes the constitution he defends, and that it is the lethal agent, speaking as it were through him, on which a defense of all these agents, common or uncommon, rests for its support.

There is one final argument which many set up who are not content with either of the two views above described. This argument is that, in the natural state of man and beast, the things which "wreathe themselves with ease in Lethe's walk" are not in any sense necessary things. On the contrary, the things are decidedly injurious, and should not be used. At the same time, it is also admitted that the indulgence in lethal agents is, in truth, a mania which begets a mania, and which inflicts all kinds of follies, crimes, and miseries on the race. But, continues the argument, the mania being admitted as such, is rendered justifiable by the circumstance that they who make it and propagate it do not start from the natural condition. They find in the world so much care, so much sorrow, so much misery, and their own path is bestrewed with so many anxieties and difficulties, that they are, in fact, diseased. All society is diseased. Therefore, to meet this vast amount and volume of disease, remedies of a palliative kind are required. Exceptional conditions call for exceptional measures. A man who can not sleep, owing to the cares and anxieties of his life, must take chloral hydrate or opium to obtain sleep. A man who can not finish a certain amount of work against time, by his own natural powers, must whip himself up to the work by means of wine; must force his heart and brain on against time at all risks and sacrifices. A man who has forced himself on against time, and has thereby obtained a momentum which he can not arrest by ordinary means, must calm himself down by tobacco, must literally put the reins on his heart, and pull the heart up sharply and decisively. These remedies, at all risks of learning to crave for them, at all risk of falling the victim to toxico-mania, must be accepted, that the work of the world may go on at full pace.

The argument is specious. If it be a sound argument, it must be

the fact that they who, for the sake of the world, are throwing their lives behind them as fast as they can, are doing more work and better work than they who, keeping their lives in their hands, are content to labor without resort to any perilous adventitious assistance. Is it so? Is the man who never touches a lethal weapon—alcohol, opium, tobacco, chloral, hasheesh, absinthe, or arsenic—a worse man, a weaker man, a less industrious man, a less-to-be-trusted man, than he who indulges in those choice weapons ever so moderately, or ever so freely? If he is, then my position is confessedly undermined, and toxico-mania is a blessing, with all its curses.—*Contemporary Review.*

SPONTANEOUS AND IMITATIVE CRIME.

By E. VALE BLAKE.

IT is not to be expected that law-makers or the administrators of legal justice should discriminate between spontaneous and imitative crime; but to the patient thinker, the medical scientist, and the practical philanthropist it is evident that the grades and distinctions of actual criminality are almost as various as the individual criminals. Even the word crime is very indefinite, and by no means always indicates the true character of an act usually so designated. Acts innocent in themselves—such, for instance, as buying goods in a foreign market and bringing them for use to this—may be made a legal crime by statute law, while other acts which are monstrous violations of natural human rights may be and are ignored by the code, and are perpetrated with impunity in the highest grades of civilized society. So, also, really criminal acts may be committed, and yet crime be absent, for the essence of crime in the individual (excluding for the present the rights of society) lies in the intention, and this element, through physiological and moral reasons, may be void. Indeed, could we apply a mental and moral vivisection to the cases of individual criminals, we should probably find unexpected variations as to the causes and influences tending to its development; but practically we may summarize the whole mass of law-breakers under either one or the other division which the title of our article indicates: and, if by some subtile alchemy we could perceive the main dividing line separating the criminal classes into those who act from the spontaneous impulses of their nature and those who are led into crime mainly by the influence of their peculiar *νόμος*, or social environment, we should be in a fair way to learn how crime might be diminished, and the so-called "dangerous classes" prevented from spreading its infection.

By spontaneous criminals we mean those who act from well-defined motives, from avarice, revenge, the gratification of pride, vanity, or the

grosser passions—also those who from congenital defects of organization have strong natural tendencies toward the commission of crime—sporadic criminals against whom it is scarcely possible for society to protect itself, unless, like the ancient Spartans, it is prepared to undertake the entire education of the future citizen, morally, intellectually, and physically, including the ante-natal period. Some recent investigations and social experiments have proved that, numerous as these are, they are a small minority as compared with those of the imitative and therefore curable class.

Alibert, the ingenious author of the "Système Sensible," regarded the *instinct of imitation* as the primordial law of nature, which has ruled, taught, and bound together the successive generations of the human race in a more potent manner than any other single faculty: and our every-day observation and experience tend to confirm the sagacity of this remark; and in the matter of crime it is certainly one of the permanent sources of its development and increase. There is one patent fact recognized by the average mind of the community, that the record and publication of any extraordinary crime is very certain to be followed by one or more examples of the same description. This certainly hints at some psychical influence worthy of examination, though it is generally dismissed with an expression as to its being a "singular fatality"—such as appears to follow certain kinds of accidents by flood or field, by land or sea.

The *forms and phases of imitation* are extremely varied—being sometimes the outcome of the conscious will, but not infrequently it is the result of an automatic sympathy with which the will has nothing to do. In many cases imitation is simply the active form of nervous sympathy and approaches the condition of mania. This instinct or faculty, like all other human attributes, may be well or ill applied, but the essential fact remains ever true that the instinct itself is irrepressible, and will exercise itself in some form: and, often as it is misused, the world could not afford to dispense with it. The race would make small progress if every man had to begin *de novo*, instead of imitating the previous acquirements of his ancestors. We may even admit, with the French philosopher, that without the perpetual use of the imitative faculty there could be no distinctive nationalities; for, is it not by successive generations imitating their parents that national customs, usages, and languages are formed, and communities consolidated so as to afford each other mutual support? And the important fact should not be lost sight of that the faculty of imitation is one of the earliest developed, and has acquired strength and vigor long before the reflective faculties or the judgment is prepared to sit in council upon these immature tendencies; particularly should this be remembered in connection with all efforts in behalf of the weaker members of our human brotherhood—whether the young, as such, or the incipient criminal, in which this faculty often plays so considerable a part;

adding complications to the history and the frequent mysteries of crime. What is that which we call "*esprit de corps*," the "spirit of the age," and other similar intangible somethings, which we know exist, but which it is difficult to embody in anything more material than a phrase? What these expressions indicate simply is, that certain numbers, greater or smaller, are prepared to imitate each other, whether it be in a crusade to the Holy Sepulchre, a Flagellant procession, or a modern strike of Crispins or engineers.

Imitative crimes are often motiveless in the ordinary meaning of the word, while numerically they really exceed all others; and it is somewhat curious that this feature of criminality has been so slightly noticed by statisticians and others concerned in the eradication of crime. Other causes of crime are certainly more obvious, for they lie upon the surface—ignorance, poverty, intemperance, the desire to live beyond one's legitimate means, unrestrained passions of all kinds: these are of course the leaders and pioneers of the great criminal army; but the rank and file are mainly made up of imitators, who do as they see others do with whom they associate. Take as an illustration the "great strike" of the railway employees some two years since, in the States of Pennsylvania and New York and elsewhere, and separate if you can the number of individuals who acted from conviction and deliberate intention—with what we might call a reason—however misguided, and the number who burned, hacked, and hewed simply because others were devastating and destroying. Could all of the mere imitators have been eliminated from those mobs it would scarcely have required military force to have dealt with the remainder, the few active, intelligent leaders of that violent mode of argument.

It will probably be admitted, in most cases of mob violence, that the mass of intimidators are ignorant, unreasoning followers, who, if they think at all, only reflect to the extent of supposing that the presence of numbers will suffice to conceal their individual share of the crime; but possibly some of our readers may not be so ready to admit that the faculty of imitation works quite as potentially in secret, where to aid it come various suggestive faculties, such as emulation, vanity, imagination, contrivance, secretiveness, hope, despair, and various other emotions. The concealed imitator broods unobserved of his fellows, and acts only when he deems himself safe from interruption.

The history of the world is full of crimes and follies committed under the influence of the imitative instinct. In many cases so devoid of thought are the actors in these scenes as scarcely to bring them under the judgment of responsible human beings. It is in fact no easy task to draw with any degree of accuracy the dividing line between folly and crime, especially when the exalted sentiments of patriotism or the fanaticism induced by the misapplication of religious dogma, or fervent appeals to the emotions, are the basis of certain wild proceedings; engaged in by assemblies of the intensely nervous, led by knaves

or the self-deceived victims of their own illusions. Under what category, for instance, should we place the "biting nuns" who appeared in rapid succession in the convents of Germany, Holland, and Rome? This extended mania arose simply from the spontaneous act of one nun attempting to bite a companion—immediately the whole sisterhood fell to biting each other. The news of this extraordinary occurrence was told from place to place, and "biting nuns" became a terror and a nuisance, over large portions of Europe in the fifteenth century; this mania proved irrepressible until exhaustion and reaction set in, terminating its abnormal absurdities.* In France another foolish epidemic of imitation seized upon many of the conventual houses. A nun one day commenced to imitate the mewing of a cat, and incontinently the other Sisters present fell to mewing. Finally the nuns took to mewing in concert for hours at a time; persuasions and commands for once failed to produce obedience. The mewing nuisance continued unabated, until the whole sisterhood were threatened with the entrance of the military, who it was announced were "coming to whip them with iron rods." The fear of these rough chastisers finally effected a cure.

That such scenes should happen, through nervous sympathy, in secluded assemblages of women, is not so very remarkable, at least is not inexplicable on nervo-physiological grounds; but we find even more disastrous examples among men, even those habitually living in the open air, within the ordinary conditions of life, and accustomed to muscular labor, which is a great tamer of the nerves. One of the most extraordinary scenes ever witnessed in wonder-producing Europe was enacted in Aix-la-Chapelle and other cities, commencing in 1374, when an assemblage of persons appeared in the famous Westphalian city, who had "danced their way through Germany." At one period the column was estimated to consist of 30,000 persons. In Metz alone there were 1,100. These people, men, women, and children, animated by an imitative delusion, apparently without any power of self-control, danced and leaped for hours at a time in the public streets of cities and on the highways of the countries through which they passed. Nothing could stop them, and they only ceased when exhausted muscles could do no more, when they fell to the ground, suffering more or less from this violent and spasmodic action. The first bands which appeared were, it is charitable to suppose, composed of sporadic cases of victims of that terrible nervous disease known in our day as St. Vitus's dance, and other nervous afflictions such as epilepsy, whom accident or sympathy had brought into companionship; but as these, at first few in number, proceeded from place to place, they were joined by others who, up to that time, had betrayed no symptoms of ill health or insanity, but who, attracted by the unusual sight, first *followed and wondered, ending by joining the leaping, dancing crowd*, to the amazement of their friends with robuster nerves, who were able to resist the fascination.

* See Zimmermann "On Solitude," vol. ii., for this and account of "mewing nuns."

These peripatetic assemblages moved in a direct line, and could only be stopped by putting obstructions in their way which were too high to be leaped over. From the violence of their exercise some were permanently injured, though many of them had been strong, athletic mechanics and peasants who had left their workshops and fields; while others continued with them for a short period, and then returned to their usual occupations as if nothing special had happened.

In Italy the dancing mania originated in the spasmodic action of a person who believed himself to have been bitten by a *tarantula*, or venomous spider, and his singular dancing movements being seen and extensively reported, every one who found a little speck or injury upon his body began to imagine that he also had been bitten, and consequently to imitate the actions of the original nervous victim. The army of imitators daily increased, and their apparent malady could only be relieved by music, mostly of a lively kind, which aided them to "dance out the attack"; it was for this purpose that the gay music now known as the *Tarentella* was invented, which has finally become a form of national music in Italy. Toward the waning of this mania, many of the poorer class, especially women, would seize upon the opportunity, whenever this music was heard in the streets, of joining the throng of dancers, so that the season for the appearance of the players—early summer—came at last to be called the "Women's Little Carnival."

A still more curious and offensive form of imitative mania, combined with imposture, was that of the various armies of Flagellants who marched through Germany and other parts of Europe; in this case the singular movement was led by designing persons who desired to undermine the power of the priesthood and to turn their dethronement to their own profit; but the mass of followers had no idea of the aim and object of the movement, viewing it, so far as they had any reason, as an act of acceptable penance: the great majority, as usual, uniting with the body simply through the irrepressible instinct of imitation—to do as others were doing, just as we have seen young people following one another up to the altar to be prayed for during a so-called revival of religion—not one in a score of whom would have ventured to be the first. Even the recent mania of suddenly "lifting" church debts by the high-pressure method of inciting the instinct of imitation and emulation in the mode of subscribing, was very sagaciously based upon this well-recognized principle that the foolish many will always try to do what the leaders of society initiate, often with as little reason as a herd of quadrupeds. The "walking" mania is a still later example of the irresistible fascination of doing what others are doing.

But it is not always in masses that the powerful instinct of imitation shows itself. In nothing is it more common than in the form which suicides adopt—and suicide is naturally enacted *à la solitaire*.

At one period in France the fashionable mode of exit was by the inhalation of charcoal-fumes, at another by a leap into the Seine. In London a certain monument had to be closed to visitors to prevent would-be suicides from following the example of an original who had thrown himself from the top. A public promenade in Berne, above the Aar, is also much affected by suicides in that vicinity. In this matter of suicide a remarkable example is given of the power influencing to direct imitation, by Dr. Carpenter in his "Mental Physiology." This case was quite devoid of excitement or of any emotional character. He says that Dr. Oppenheim, of Hamburg, having received for dissection the body of a man who had committed suicide by cutting his throat, but who had performed the deed in such an inartistic manner that his death did not take place until after an interval of great suffering, jokingly remarked to his attendant: "If you have any fancy to cut your throat, don't do it in such a bungling way as this—a little more to the left here, and you will cut the carotid artery." The individual to whom this dangerous advice was addressed was a sober, steady man, with a family and a comfortable subsistence; he had never manifested the slightest tendency to suicide, and had no motive to commit it; yet, strange to say, the sight of the corpse and the observation made by Dr. Oppenheim, suggested to his mind the desire to imitate the deed, and this took such firm hold of him that he carried it into execution, fortunately, however, without duly profiting by the anatomical instruction he had received, for he failed to cut the carotid artery, and recovered. Here, plainly, the *ideational form of imitation* took possession of the man's mind, and forced him to the act. Subsequently to the remark of the Doctor, he had evidently brooded over the matter till the desire to imitate the suicide became irresistible. Had Dr. Oppenheim anticipated any result from a casual remark, he would probably have said: "Don't think about this body after you leave here; occupy your mind with some other subject—if possible, a pleasant one."

A curious case of suicidal mania occurred a few years since, under the writer's own observation, in Essex County, New Jersey, where a young man of feeble intellect, but exceedingly susceptible to praise and sympathetic emotions, committed suicide, with the evident intent of drawing out the pity and sympathy of his friends. He had attended one or more funerals where eulogies of the deceased, flowers, and other tokens of kind feeling abounded, and he desired to be in the place of the corpse, and to know that such a scene would be imitated in his case—his limited reasoning powers not suggesting that he would then be insensible to the friendly manifestations. The imitative instinct was too strong for the reflective faculties and determined the fatal act.

Another case in point is that of an eminent physician who, in relating his own experience while suffering under an attack of fever attended with delirium, states that, being obliged to call in a colleague

for treatment, he heard his friend caution the nurse to "keep the windows closed, as one of his fever-patients had attempted to jump out." No sooner had the sick man heard this than he set his mind to circumvent his attendant and jump out of the window, though, until he had heard the cautioning remarks, such a desire had not occurred to him. His intention was happily frustrated, and, as soon as he recovered, he resumed his hospital practice. Strangely forgetting the presence of the patients, he related to some of the other physicians present his experience, and was only made aware of his imprudence when told that, after he had left, several of the sick had risen from their beds and attempted to jump out of the windows.

Without endorsing the apothegm of the able author of the "Intellectual Development of Europe," that "the equilibrium and movements of humanity are *altogether physiological phenomena*, and that the succession of events are the inevitable results of a law depending on, or the consequences of physical conditions," we are persuaded that a large proportion of crime is to be attributed to the responsive nature of the physical organization. Among unsophisticated persons, untrammeled by etiquette, there are many who can not hear a march played without attempting to keep step with the music, or a waltz without an instinctive desire to dance. There is, indeed, a certain amount of rhythmical response in most of us to the time measurements of harmony—particularly when lively airs are played; but as some more than others are easily affected by moral and physical harmonies, may there not be other souls, or vitalized bodies, which spontaneously respond to the moral and physical discords—people who may be said to be out of tune with the organized harmonies of society, and whose natural impulse is to put these into modes of activity?

Plato recognized these differences in the impulses of persons differently constituted and educated; he says in vol. iv. of his "Laws," "I do not expect or imagine that any well-brought-up citizen will ever take the infection [of crime], but their servants or those of strangers may." Speaking of those who might be tempted to crime, he perceives very clearly the power of association over the imitative instinct of human beings, especially of those who dwell together, and he thus advises: "When any such ill thought [as that of committing a crime] comes into your mind, go at once to the society of those who are called good among you. Fly from the wicked; fly, and turn not back, and, if thy disorder is lightened by these remedies, well and good; but if not, then acknowledge death to be nobler than life, and depart hence."

Without going so far as the noble Greek, and recommending suicide to those cursed with evil instincts, we concede that the first part of his advice is as sound to-day as it was two thousand years ago. The power of a dominant idea is almost irresistible in some natures; and, therefore, it should be the aim of every philanthropist, whose efforts are directed to the reduction of crime, to seek the introduction of

good and noble thoughts particularly among the young of the tempted classes; for all normal or abnormal action is derived from the thoughts, and as the thoughts are, so will the life be. In those particular localities where crime seeks to shelter and hide itself among numbers, the suggestions to wrong-doing are ever present, and the young, who as yet have the criminal instinct only latent, but who still must be regarded from the circumstances as incipient criminals, are the objects which offer the best promises of success in any effort for the reduction of crime. There is also this promising feature in reformatory efforts, *that the moral emotions, once thoroughly awakened, do not satiate and deaden by exercise*, like many pleasurable vices; they are not in their nature exhaustive, but strengthen by habit and prove more satisfying by use and perseverance, till they become almost automatic, when the individual may be considered practically safe.

It is well understood by natural scientists that in the noblest forms of animal life—such, for instance, as the thoroughbred horse—the likeness of parent and offspring is much more strongly marked than in lower forms of life. If we carry our investigations low enough—down to the border-land between the animal and vegetable kingdoms, such as some forms of marine life, hydro-zoöphytes, salpa, and medusæ—we discover a *curious law of unlikeness* or alternation of forms, in which the immediate offspring are totally unlike their progenitors, but possess a resemblance to their ancestors one degree further removed, and this alternation goes on with an invariable tendency in the third generation to revert to the form of the first instead of assuming that of the second. This polymorphic tendency of low types of life is also illustrated in the vegetable world, for, while the higher classes retain, under all conditions, their normal form, whether planted in favorable or unfavorable soil (the oak is still an oak, the rose a rose), the germs of the simpler fungi develop surprising variations of form if placed on different kinds of decomposing matter; so far have these changes proceeded as to cause investigators to mistake them, not only for different species, but for different genera. It thus appears to be a law of nature that the *nobler the production the more type-giving power it possesses*, while the weaker and simpler are dominated by circumstances, and, if weak and low enough, do not necessarily impress their own image on their successors. May not this law apply to some extent to the human race? The nobler specimens of humanity will, we know, maintain their manhood and moral integrity under the most adverse circumstances, but, if we get down low enough in the human scale, shall we not find the fungi of the race, the weakest of our brothers, who have not moral stamina enough to hold their own elected way, but ever show themselves the creatures of circumstances, and are developed into just such moral or immoral characters as their environments suggest? These are the people whose course is always "in the direction of the least resistance," who, if they are placed un-

der good influences, will lead at least quiet and orderly lives, but who are equally plastic to evil, and who will inevitably bloom into criminality if surrounded by lawless associates.

From two persons who have had extensive acquaintance with criminals, as also with those living in ignorance and poverty, which too often prove the approximate cause of crime, we are able to draw conclusive reasons for believing that the instinct of imitation may be used with astonishing effect, if rightly directed over those whose habits have not become irretrievably fixed. The author of "The Juke Family," on the one hand, and the author of "The Dangerous Classes," on the other, have done much to prove this hypothesis. Mr. Dugdale selected for his elaborate analysis the history of an extensive family, some of whom are yet living, whom he calls the Jukes; these he follows through town registers, almshouses, court-records, hospitals, prisons, etc., for six generations, from 1720 to 1872. For greater certainty in tracing the hereditary influence, he follows the female line of descent with the most definite results; his minute research, as to the character and fate of these persons, proves that where any member of the family was removed from the influence and example of crime, either by adoption into or marriage with honest and respectable families, the criminal tendencies disappeared, and the individuals reverted to a reputable life. Thus the imitative faculty was found, even in these cases where vicious blood was a recognized inheritance, to be as active in the imitation of good as of evil ways of living.

Particularly was this the case with those members of this criminal family who escaped from the vicious environment before the age of eighteen—these all took to honest ways, imitating the honest people with whom they lived; notably one who at the age of fifteen married a faithful and industrious German—this branch of the female line never produced a criminal, which was a remarkable exception with the Jukes. Another point bearing on the argument of the propelling influence of imitation is the discovery of the fact that where relatives of the poor have received shelter in almshouses, the children of these more readily resort to them in emergencies than do others in more pressing need, who have had no such record in their families. In fact, pauperism of the chronic kind is more difficult to cure than a tendency to criminality—for the first indicates weakness, the latter vitality.

As a general rule it may be assumed that before maturity the life of every individual is in the main imitative; later, experience and social compulsion reach the reason and teach all persons of average brain-power and moral culture that conformity to the laws of society is in the end more profitable than crime. The exceptions to this rule will be certain to exhibit some form of abnormal development. But the important practical truth is manifest, that while there is *growth in the substance-matter of the brain*, and this organ is acquiring func-

tional habits which are eventually to become automatic mental phenomena, it is of immense importance that every means should then be adopted to eradicate hereditary tendencies to abnormal action of that organ, for while there is growth there may be change of direction, while every year after maturity lessens the chances of this. It may likewise be understood that to a permanent cure of hereditary tendency to crime separation from contaminating example is essential, and this separation must be permanent. Criminals who have acquired habits of industry and self-control during the discipline of a term of imprisonment might reasonably be expected to retain them if placed on their release in conditions which insured paying work and a pure moral atmosphere; but they will inevitably relapse if thrown back into their old circle, where crime and its contrivance are the main business of life. Therefore all discharged convicts, more especially those of the chronic sort, ought to be encouraged, and if necessary aided, to seek a new residence, and by all means persuaded to avoid their old haunts.

That the hereditary taint may be overcome by subsequent training and a lengthened discipline of a judicious kind is proved by the fact that the convicts sent out to Botany Bay by the British Government in general reformed, through the new hopes inspired by new circumstances in a new land, away from their old haunts and habitudes, and their children have reverted to honest and respectable lives. Medical science also shows that the instinctive or ante-natal qualities may be outweighed by the cultivation of the post-natal or reasoning.

It is shown by prison registers and statistics that *sporadic crime* among the educated, and those of honest parentage—that is, in families which have no examples of criminal courses in their direct ancestry—amounts to *but two per cent.*; an overwhelming argument in favor of preventive measures and their value above corrective penalties.

That crime usually *coexists with ignorance and an ill-balanced brain* is shown in the fact that in the large majority of criminals the faculty of arithmetical calculation is almost wholly lacking. Extensive experimental investigations have shown that the average prisoner can not answer the questions, "How much do you make?" "What pay or income would keep you honest?" The reflective qualities are more or less lacking or enfeebled in all descendants from neurotic stock.

Of all the means best adapted for the propagation of crime is that of herding criminals together, especially in juvenile asylums. Several witnesses from the House of Refuge in New York testified that they had there learned from more expert criminals tricks in stealing, picking locks, and in the concealment of stolen goods, which they had never learned outside.

The labors of many philanthropists for the last quarter of a century have shown conclusively that, if the young are seasonably removed from unfavorable environment, but a very small percentage deliberately return to vicious courses; but that they willingly learn

to imitate the industrious and honest habits of their guardians and neighbors, exemplifying the logic of reason, that "an ounce of prevention is better than a pound of cure."

Observing the analogies of nature might teach the social scientist as well as the philanthropist that the measures taken to produce excellence in the animal and vegetable kingdoms are equally applicable to human beings. And what is the course of an arboriculturist or horticulturist if a plant shows abnormal qualities and a tendency to disease? If the owner desires to restore it to a healthy condition, would he allow it to remain among the aborted or monstrous members of its kind? Would he not rather remove it from the soil where its development had proved so unfortunate, to better-selected ground, and to the vicinity of normal healthy plants? So with stock: no breeder of horses or cattle would hope to cure a distemper among his animals if he allowed the diseased to herd together, mutually infecting each other. No, the worst cases he would speedily remove and isolate, and all in succession who showed symptoms likely to result disastrously to themselves or others. The sick would be put into clean quarters, and a more careful system of air and diet provided. Can we expect to cure abnormally developed human beings with less trouble?

The conclusion to be drawn from these considerations of the different phases of crime suggests at least this practical idea: that, *in all stages of education, the proper direction of the will, the due control of the emotions, and the subjection of nervous impulses to the cool judgment of the reason*, are far more important than the mere acquisition of this or that branch of so-called knowledge. A large majority of crimes, particularly crimes of violence, occur because the perpetrators have never been taught or compelled to control their feelings; probably nine tenths of all the crimes, follies, and disasters of which human beings are victims, might be prevented if the youth of the country were habitually instructed in the danger of allowing themselves to be controlled by impulse and feeling—if they could be taught that their nerves and muscles, as well as their desires, should be always under the direction of the intellect or will: and, if this sort of education could supplant that which is usually given to girls and young ladies, might we not hope to see a diminution of that weakly, nervous, hysterical class, which we are almost tempted to rank as criminal, since their very existence is a bane to every family in which they exist? To diminish crimes of all sorts, let the teaching of self-control, the subordination of the emotions to the will, a knowledge of the nervous system, and a worthy, definite object in life, become a part of the education of every youth, male and female. Many crimes which are penally punished are the outcome of semi-insane persons, whose really abnormal condition is not recognized by court or jury, while others are excused as insane when their culminating crime is but the outcome of habitual indulgence of violent temper. Of all the insane, but the

smallest fractional part are the result of excessive intellectual effort; a somewhat larger number arise from structural disease; but the great majority of the insane who have committed or attempted to commit crimes have lost control of their reason because they *habitually allowed passion, not reason, to control them.* Therefore, we repeat, the greatest possible preventive of crime is to raise a race who shall know how to *control their emotional natures* through an enlightened will and the habitual exercise of a moral judgment.

MATERIALISM AND ITS LESSONS.

By Dr. HENRY MAUDSLEY.

IT is well known that from an early period of speculative thought two doctrines have been held with regard to the sort of connection which exists between a man's mind and his body. On the one hand, there are those who maintain that mind is an outcome and function of matter in a certain state of organization, coming with it, growing with it, decaying with it, inseparable from it: they are the so-called materialists. On the other hand, there are those who hold that mind is an independent spiritual essence which has entered into the body as its dwelling-place for a time, which makes use of it as its mortal instrument, and which will take on its independent life when the body, worn out by the operation of natural decay, returns to the earth of which it is made: they are the spiritualists. Without entering into a discussion as to which is the true doctrine, it will be sufficient in this article to accept, and proceed from the basis of, the generally admitted fact that all the manifestations of mind which we have to do with in this world are connected with organization, dependent upon it, whether as cause or instrument; that they are never met with apart from it any more than electricity or any other natural force is met with apart from matter, and that higher organization must go along with higher mental function. What is the state of things in another world—whether the disembodied or celestially embodied spirits of the countless myriads of the human race that have come and gone through countless ages are now living higher lives—I do not venture to inquire. One hope and one certitude in the matter every one may be allowed to have and to express—the hope that, if they are living now, it is a higher life than they lived upon earth; the certitude that, if they are living the higher life, most of them must have had a vast deal to unlearn.

Many persons who readily admit in general terms the dependence of mental function on cerebral structure are inclined, when brought to the particular test, to make an exception in favor of the moral feeling or

conscience. They are content to rest in the uncertain position which satisfied Dr. Abercrombie, the distinguished author of the well-known "Inquiry concerning the Intellectual Powers," who, having pointed out plainly the dependence of mental function on organization, and, as a matter of fact which can not be denied, that there are individuals in whom every correct feeling in regard to moral relations is obliterated, while the judgment is unimpaired in all other relations, stops there without attempting to prosecute inquiry into the cause of the remarkable fact which he justly emphasizes. "That this power," he says, "should so completely lose its sway, while reason remains unimpaired, is a point in the moral constitution of man which it does not belong to the physician to investigate. The fact is unquestionable; the solution is to be sought in the records of eternal truth." And with this lame and somewhat melancholy conclusion he leaves his readers impotent before a problem which is not only of deep scientific interest, but of momentous practical importance. The observation which makes plain the fact does not, however, leave us entirely without information concerning the cause of it, when we pursue it faithfully, since it reveals as distinct a dependence of moral faculty upon organization as of any other faculty.

Many instructive examples of the pervading mental effects of physical injury of the brain might be quoted, but two or three, recently recorded, will suffice. An American medical man was called one day to see a youth, aged eighteen, who had been struck down insensible by the kick of a horse. There was a depressed fracture of the skull a little above the left temple. The skull was trephined, and the loose fragments of bone that pressed upon the brain were removed, whereupon the patient came to his senses. The doctor thought it a good opportunity to make an experiment, as there was a hole in the skull through which he could easily make pressure upon the brain. He asked the boy a question, and before there was time to answer it he pressed firmly with his finger upon the exposed brain. As long as the pressure was kept up the boy was mute, but the instant it was removed he made a reply, never suspecting that he had not answered at once. The experiment was repeated several times with precisely the same result, the boy's thoughts being stopped and started again on each occasion as easily and certainly as the engineer stops and starts his locomotive.

On another occasion the same doctor was called to see a groom who had been kicked on the head by a mare called Dolly, and whom he found quite insensible. There was a fracture of the skull, with depression of bone at the upper part of the forehead. As soon as the portion of bone which was pressing upon the brain was removed the patient called out with great energy, "Whoa, Dolly!" and then stared about him in blank amazement, asking: "Where is the mare? Where am I?" Three hours had passed since the accident, during

which the words which he was just going to utter when it happened had remained locked up, as they might have been locked up in the phonograph, to be let go the moment the obstructing pressure was removed. The patient did not remember, when he came to himself, that the mare had kicked him; the last thing before he was insensible which he did remember was, that she wheeled her heels round and laid back her ears viciously.

Cases of this kind show how entirely dependent every function of mind is upon a sound state of the mechanism of the brain. Just as we can, by pressing firmly upon the sensory nerve of the arm, prevent an impression made upon the finger being carried to the brain and felt there, so by pressing upon the brain we can as certainly stop a thought or a volition. In both cases a good recovery presently followed the removal of the pressure upon the brain; but it would be of no little medical interest to have the after-histories of the persons, since it happens sometimes after a serious injury to the head that, despite an immediate recovery, slow, degenerative changes are set up in the brain months or years afterward, which go on to cause a gradual weakening, and perhaps eventual destruction, of mind. Now the instructive matter in this case is that the moral character is usually impaired first, and sometimes is completely perverted, without a corresponding deterioration of the understanding; the person is a thoroughly changed character for the worse. The injury has produced disorder in the most delicate part of the mental organization, that which is separated from actual contact with the skull only by the thin investing membranes of the brain; and, once damaged, it is seldom that it is ever restored completely to its former state of soundness. However, happy recoveries are now and then made from mental derangement caused by physical injury of the brain. Some years ago a miner was sent to the Ayrshire District Asylum, who, four years before, had been struck to the ground insensible by a mass of falling coal, which fractured his skull. He lay unconscious for four days after the accident, then came gradually to himself, and was able in four weeks to resume his work in the pit. But his wife noticed a steadily increasing change for the worse in his character and habits; whereas he had formerly been cheerful, sociable, and good-natured, always kind and affectionate to her and his children, he now became irritable, moody, surly, suspicious, shunning the company of his fellow workmen, and impatient with her and the children. This bad state increased; he was often excited, used threats of violence to his wife and others, finally became quite maniacal, attempted to kill them, had a succession of epileptic fits, and was sent to the asylum as a dangerous lunatic. There he showed himself extremely suspicious and surly, entertained a fixed delusion that he was the victim of a conspiracy on the part of his wife and others, and displayed bitter and resentful feelings. At the place where the skull had been fractured there was a well-marked depres-

sion of bone, and the depressed portion was eventually removed by the trephine. From that time an improvement took place in his disposition, his old self coming gradually back; he became cheerful again, active and obliging, regained and displayed all his former affection for his wife and children, and was at last discharged recovered. No plainer example could be wished to show the direct connection of cause and effect—the great deterioration of moral character produced by the physical injury of the supreme nerve-centers of the brain: when the cause was taken away the effect went also.

Going a step further, let me point out that disease will sometimes do as plain and positive damage to moral character as any which direct injury of the brain will do. A fever has sometimes deranged it as deeply as a blow on the head; a child's conscience has been clean effaced by a succession of epileptic convulsions, just as the memory is sometimes effaced; and those who see much of epilepsy know well the extreme but passing moral transformations that occur in connection with its seizures. The person may be as unlike himself as possible when he is threatened with a fit; although naturally cheerful, good-tempered, sociable, and obliging, he becomes irritable, surly, and morose, very suspicious, takes offense at the most innocent remark or act, and is apt to resent imaginary offenses with great violence. The change might be compared well with that which happens when a clear and cloudless sky is overcast suddenly with dark and threatening thunder-clouds; and just as the darkly clouded sky is cleared by the thunder-storm which it portends, so the gloomy moral perturbation is discharged and the mental atmosphere cleared by an epileptic fit or a succession of such fits. In a few remarkable cases, however, the patient does not come to himself immediately after the fit, but is left by it in a peculiar state of quasi-somnambulism, during which he acts like an automaton, doing strange, absurd, and sometimes even criminal things, without knowing apparently at the time what he is doing, and certainly without remembering in the least what he has done when he comes to himself. Of excellent moral character habitually, he may turn thief in one of these states, or perpetrate some other criminal offense by which he gets himself into trouble with the police.

There are other diseases which, in like manner, play havoc with moral feeling. Almost every sort of mental derangement begins with a moral alienation, slight perhaps at the outset, but soon so great that a prudent, temperate, chaste, and truthful person shall be changed to exactly the opposite of what he was. This alienation of character continues throughout the course of the disease, and it is frequently found to last for a while after all disorder of intelligence has gone. Indeed, the experienced physician never feels confident that the recovery is stable and sure, until the person is restored to his natural sentiments and affections. Thus it appears that when mind undergoes decadence, the moral feeling is the first to suffer; the highest acquisi-

tion of mental evolution, it is the first to witness to mental degeneracy. One form of mental disease, known as general paralysis, is usually accompanied with a singularly complete paralysis of the moral sense from the outset; and a not uncommon feature of it, very striking in some cases, is a persistent tendency to steal, the person stealing in a weak-minded manner what he has no particular need of, and makes no use of when he has stolen it. The victim of this fatal disease is frequently sent to prison and treated as a common criminal in the first instance, notwithstanding that a medical man who knows his business might be able to say with entire certitude that the supposed criminal was suffering from organic disease of the brain, which had destroyed moral sense at the outset, which would go on to destroy all the other faculties of his mind in succession, and which in the end would destroy life itself. There is no question in such case of moral guilt; it is not sin but disease that we are confronted with; and after the victim's death we find the plainest evidence of disease of brain, which has gone along with the decay of mind. Had the holiest saint in the calendar been afflicted as he was, he could not have helped doing as he did.

I need not dwell any longer upon the morality-sapping effects of particular diseases, but shall simply call to mind the profound deterioration of moral sense and will which is produced by the long-continued and excessive use of alcohol and opium. There is nowhere a more miserable specimen of degradation of moral feeling and of impotence of will than the debauchee who has made himself the abject slave of either of these pernicious excesses. Insensible to the interests of his family, to his personal responsibilities, to the obligations of duty, he is utterly untruthful and untrustworthy, and in the worst end there is not a meanness of pretense or of conduct that he will not descend to, not a lie he will not tell, in order to gain the means to gratify his overruling craving. It is not merely that passion is strengthened and will weakened by indulgence as a moral effect, but the alcohol or opium which is absorbed into his blood is carried by it to the brain and acts injuriously upon its tissues: the chemist will, indeed, extract alcohol from the besotted brain of the worst drunkard, as he will detect morphia in the secretions of a person who is taking large doses of morphia. Seldom, therefore, is it of the least use to preach reformation to these people, until they have been restrained forcibly from their besetting indulgence for a long enough period to allow the brain to get rid of the poison, and its tissues to regain a healthier tone. Too often it is of little use then; the tissues have been damaged beyond the possibility of complete restoration. Moreover, observation has shown that the drink-craving is oftentimes hereditary, so that a taste for the poison is ingrained in the tissues, and is quickly kindled by gratification into uncontrollable desire.

Thus far it appears, then, that moral feeling may be impaired or

destroyed by direct injury of the brain, by the disorganizing action of disease, and by the chemical action of certain substances which, when taken in excess, are poisons to the nervous system. When we look sincerely at the facts, we can not help perceiving that it is just as closely dependent upon organization as is the meanest function of mind; that there is not an argument to prove the so-called materialism of one part of mind which does not apply with equal force to the whole mind. Seeing that we know no more essentially what matter is than what mind is, being unable in either case to go beyond the phenomena of which we have experience, it is of interest to ask why the spiritualist considers his theory to be of so much higher an intellectual and moral order than materialism, and looks down with undisguised pity and contempt on the latter as inferior, degrading, and even dangerous; why the materialist should be deemed guilty, not of intellectual error only, but of something like moral guilt. His philosophy has been lately denounced as a "philosophy of dirt." An eminent prelate of the English Church, in an outburst of moral indignation, once described him as possibly "the most odious and ridiculous being in all the multiform creation"; and a recent writer in a French philosophical journal uses still stronger language of abhorrence: "I abhor them," he says, "with all the force of my soul. . . . I detest and abominate them from the bottom of my heart, and I feel an invincible repugnance and horror when they dare to reduce psychology and ethics to their bestial physiology—that is, in short, to make of man a brute, of the brute a plant, of the plant a machine. . . . This school is a living and crying negation of humanity." The question is, what there is in materialism to warrant the sincere feeling and earnest expression of so great a horror of it. Is the abhorrence well founded, or is it, perhaps, that the doctrine is hated, as the individual oftentimes is, because misunderstood?

This must certainly be allowed to be a fair inquiry by those who reflect that no less eminent a person and good a Christian than Milton was a decided materialist. Several scattered passages in "Paradise Lost" plainly betray his opinions; but it is not necessary to lay any stress upon them, because in his "Treatise on Christian Doctrine" he sets them forth in the most plain and uncompromising way, and supports them with an elaborate detail of argument. He is particularly earnest to prove that the common doctrine that the spirit of man should be separate from the body, so as to have a perfect and intelligent existence independently of it, is nowhere said in Scripture, and is at variance both with nature and reason; and he declares that "man is a living being, intrinsically and properly one and individual, not compound and separable, not, according to the common opinion, made up and framed of two distinct parts, as of soul and body." Another illustrious instance of a good Christian who for a great part of his life avowed his belief that "the nature of man is simple and uni-

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form, and that the thinking power and faculties are the result of a certain organization of matter," was the eloquent preacher and writer, Robert Hall. It is true that he abandoned this opinion at a later period of his life; indeed, his biographer tells us with much satisfaction that "he buried materialism in his father's grave"; and a theological professor in an American college has in a recent article exultantly claimed this fact as triumphant proof that the materialist's "gloomy and unnatural creed" can not stand before such a sad feeling as grief at a father's death. One may be excused, perhaps, for not seeing quite so clearly as these gentlemen the soundness of the logic of the connection. On the whole, logic is usually sounder and stronger when it is not under the pressure of great feeling.

The truth is, that a great many people have the deeply-rooted feeling that materialism is destructive of the hope of immortality, and dread and detest it for that reason. When they watch the body decay and die, considering furthermore that after its death it is surely resolved into the simple elements from which all matter is formed, and know that these released elements go in turn to build up other bodies, so that the material is used over and over again, being compounded and decompounded incessantly in the long stream of life, they can not realize the possibility of a resurrection of the individual body. They can not conceive how matter, which has thus been used over and over again, can remake so many distinct bodies, and they think that to uphold a bodily resurrection is to give up practically the doctrine of a future life. It is a natural but not a necessary conclusion, as the examples of Milton and Robert Hall prove, since they, though materialists, were devout believers in a resurrection of the dead. Moreover, there are many vehement antagonists of materialism who readily admit that it is not inconsistent with the belief in a life after death. Indeed, they could not well do otherwise when they recollect what the Apostle Paul said in his very energetic way, addressing the objector to a bodily resurrection as "Thou fool!" and what happened to the rich man who died and was buried; for it is told of him that "in hell he lifted up his eyes and cried and said, 'Father Abraham, have mercy on me, and send Lazarus that he may dip the tip of his finger in water and cool my tongue, for I am tormented in this flame.'" Now, if he had eyes to lift up and a tongue to be cooled, it is plain that he had a body of some kind in hell; and if Lazarus, who was in another place, had a finger to dip in water, he also must have had a body of some kind there.

Leaving this matter, however, without attempting to explain the mystery of the body celestial, I go on to mention a second reason why materialism is considered to be bad doctrine. It is this: that with the rise and growth of Christianity there came in the fashion of looking down on the body with contempt as the vile and despicable part of man, the seat of those fleshly lusts which warred against the higher

aspirations of the soul. It was held to be the favorite province of the devil, who, having intrenched himself there, lay in wait to entice or to betray to sin; the wiles of Satan and the lusts of the flesh were spoken of in the same breath, as in the service of the English Church prayer is made for "whatsoever has been decayed by the fraud and malice of the devil, or by his own carnal will and frailness"; and all men are taught to look forward to the time when "he shall change this vile body and make it like unto his glorious body." It was the extreme but logical outcome of this manner of despising the body to subject it to all the penances, and to treat it with all the rigor, of the most rigid asceticism—to neglect it, to starve it, to scourge it, to mortify it in every possible way. One holy ascetic would never wash himself, or cut his toe-nails, or wipe his nose; another suffered maggots to burrow unchecked into the neglected ulcers of his emaciated body; others, like St. Francis, stripped themselves naked and appeared in public without clothes. St. Macarius threw away his clothes and remained naked for six months in a marsh, exposed to the bite of every insect; St. Simeon Stylites spent thirty years on the top of a column which had been gradually raised to a height of sixty feet, spending a great part of his time in bending his meager body successively with his head toward his feet, and so industriously that a curious spectator, after counting twelve hundred and forty-four repetitions, desisted counting from weariness. And for these things —these insanities of conduct may we not call them?—they were accounted most holy, and received the honors of saintship. Contrast this unworthy view of the body with that which the ancient Greeks took of it. They found no other object in nature which satisfied so well their sense of proportion and manly strength, of attractive grace and beauty; and their reproductions of it in marble we preserve now as priceless treasures of art, albeit we still babble the despicable doctrine of contempt of it. The more strange, since it is a matter of sober scientific truth that the human body is the highest and most wonderful work in nature, the last and best achievement of her creative skill; it is a most complex and admirably constructed organism, "fearfully and wonderfully made," which contains, as it were in a microcosm, all the ingenuity and harmony and beauty of the macrocosm. And it is this supreme product of evolution that fanatics have gained the honor of saintship by disfiguring and torturing!

These, then, are two great reasons of the repugnance which is felt to materialism, namely, the notion that it is destructive of the hope of a resurrection, and the contempt of the body which has been inculcated as a religious duty. And yet on these very points materialism seems fitted to teach the spiritualist lessons of humility and reverence, for it teaches him, in the first place, not to despise and call unclean the last and best work of his Creator's hand; and, secondly, not impiously to circumscribe supernatural power by the narrow limits of

his understanding, but to bethink himself that it were just as easy in the beginning, or now, or at any time, for the omnipotent Creator of matter and its properties to make it think as to make mind think.

Passing from these incidental lessons of humility and reverence, I go on now to show that materialism has its moral lessons, and that these, rightly apprehended, are not at all of a low intellectual and moral order, but, on the contrary, in some respects more elevating than the moral lessons of spiritualism. I shall content myself with two or three of these lessons, not because there are not more of them, but because they will be enough to occupy the space at my disposal.

It is a pretty well accepted scientific doctrine that our far-distant prehistoric ancestors were a very much lower order of beings than we are, even if they did not inherit directly from the monkey; that they were very much like, in conformation, habits, intelligence, and moral feeling, the lowest existing savages; and that we have risen to our present level of being by a slow process of evolution which has been going on gradually through untold generations. Whether or not "through the ages one increasing purpose runs," as the poet has it, it is certainly true that "the thoughts of men are widened with the process of the suns." Now, when we examine the brain of the lowest savage, whom we need not be too proud to look upon as our ancestor in the flesh—say a native Australian or a Bushman—we find it to be considerably smaller than an ordinary European brain; its convolutions, which are the highest nerve-centers of mind, are decidedly fewer in number, more simple in character, and more symmetrical in arrangement. These are marks of inferiority, for in those things in which it differs from the ordinary European brain it gets nearer in structure to the still much inferior brain of the monkey; it represents, we may say, a stage of development in the long distance which has been traversed between the two. A comparison of the relative brain-weights will give a rude notion of the differences: the brain-weight of an average European male is forty-nine ounces; that of a Bushman is, I believe, about thirty-three ounces; and that of a negro, who comes between them in brain-size, as in intelligence, is forty-four ounces. The small brain-weight of the Bushman is indeed equaled among civilized nations by that of a small-headed or so-called microcephalic idiot. There can be no doubt, then, of a great difference of development between the highest and the lowest existing human brain.

There can be no doubt, furthermore, that the gross differences which there are between the size and development of the brain of a low savage and of an average European, go along with as great differences of intellectual and moral capacities—that lower mental function answers to lower cerebral structure. It is a well-known fact that many savages can not count beyond five, and that they have no words in their vocabulary for the higher qualities of human nature, such as virtue, justice, humanity, and their opposites, vice, injustice, and

cruelty, or for the more abstract ideas. The native Australian, for example, who is in this case, having no words for justice, love, mercy, and the like, would not in the least know what remorse meant; if any one showed it in his presence, he would think probably that he had got a bad headache. He has no words to express the higher sentiments and thoughts because he has never felt and thought them, and has never had, therefore, the need to express them; he has not in his inferior brain the nervous substrata which should minister to such sentiments and thoughts, and can not have them in his present state of social evolution, any more than he could make a particular movement of his body if the proper muscles were wanting. Nor could any amount of training in the world, we may be sure, ever make him equal in this respect to the average European, any more than it could add substance to the brain of a small-headed idiot and raise it to the ordinary level. Were any one, indeed, to make the experiment of taking the young child of an Australian savage and of bringing it up side by side with an average European child, taking great pains to give them exactly the same education in every respect, he would certainly have widely different results in the end: in the one case he would have to do with a well-organized instrument, ready to give out good intellectual notes and a fine harmony of moral feeling when properly handled; in the other case, an imperfectly organized instrument, from which it would be out of the power of the most patient and skillful touch to elicit more than a few feeble intellectual notes and a very rude and primitive sort of moral feeling—a little better feeling, certainly, than that of its fathers, but still most primitive; for many savages regard as virtues most of the big vices and crimes, such as theft, rape, murder, at any rate when they are practiced at the expense of neighboring tribes. Their moral feeling, such as it is, is extremely circumscribed, being limited in application to the tribe. In Europe we have happily got further than that, since we are not, as savages are and our forefathers probably were, divided into a multitude of tribes eager to injure and even extirpate one another from motives of tribal patriotism; but mankind seems to be far off the goal of its high calling so long as, divided into jealous and hostile nations, it suffers national divisions to limit the application of moral feeling, counts it a high virtue to violate it under the profaned name of patriotism, and uses the words "humanitarianism" and "cosmopolitanism" as crushing names of reproach. There is plainly room yet for a wider expansion of moral feeling.

Now, what do the discoveries of science warrant us to conclude respecting the larger and more complex brain of the civilized man and its higher capacities of thought and feeling? They teach us this: that it has reached its higher level not by any sudden and big creative act, nor by a succession of small creative acts, but by the slow and gradual operation of processes of natural evolution going on through

countless ages. Each new insight into natural phenomena on the part of man, each act of wiser doing founded on truer insight, each bettered feeling which has been developed from wiser conduct, has tended to determine by degrees a corresponding structural change of the brain, which has been transmitted as an innate endowment to succeeding generations, just as the acquired habit of a parent animal becomes sometimes the instinct of its offspring; and the accumulated results of these slow and minute gains, transmitted by hereditary action, have culminated in the higher cerebral organization, in which they are now, as it were, capitalized. Thus the added structure embodies in itself the superior intellectual and moral capacities of abstract reasoning and moral feeling which have been the slow acquisitions of the ages, and it gives them out again in its functions when it discharges its functions rightly. If we were to have a person born in this country with a brain of no higher development than that of the low savage—destitute, that is, of the higher nervous substrata of thought and feeling—if, in fact, our far remote prehistoric ancestors were to come to life among us now—we should have more or less of an imbecile, who could not compete on equal terms with other persons, but must perish, unless charitably cared for, just as the native Australian perishes when he comes into contact and competition with the white man. The only way in which the native Australian could be raised to the level of civilized feeling and thought would be by cultivation continued through many generations—by a process of evolution similar to that which lies back between our savage ancestors and us.

That is one aspect of the operation of natural law in human events—the operation of the law of heredity in development, in carrying mankind forward, that is, to a higher level of being. It teaches us plainly enough that the highest qualities of mind bear witness to the reign of law in nature as certainly as do the lowest properties of matter, and that if we are to go on progressing in time to come, it must be by observation of, and obedience to, the laws of development. But there is another vastly important aspect of the law of heredity, which it concerns us to bear sincerely in mind—its operation in working out human degeneracy, in carrying mankind downward, that is, to a lower level of being. It is certain that man may degenerate as well as develop; that he has been doing so both as nation and individual ever since we have records of his doings on earth. There is a broad and easy way of dissolution, national, social, or individual, which is the opposite of the steep and narrow way of evolution. Now, what it behooves us to realize distinctly is, that there is not anything more miraculous about the degeneracy and extinction of a nation or of a family than there is about its rise and development; that both are the work of natural law. A nation does not sink into decadence, I presume, so long as it keeps fresh those virtues of character through which it became great among nations; it is when it suffers them to be eaten away

by luxury, corruption, and other enervating vices, that it undergoes that degeneration of character which prepares and makes easy its overthrow. In like manner a family, reckless of the laws of physical and moral hygiene, may go through a process of degeneracy until it becomes extinct. It was no mere dream of prophetic frenzy that when the fathers have eaten sour grapes the children's teeth are set on edge, nor was it a meaningless menace that the sins of the fathers shall be visited upon the children unto the third and fourth generations; it was an actual insight into the natural law by which degeneracy increases through generations—by which one generation reaps the wrong which its fathers have sown, as its children in turn will reap the wrong which it has sown. What we call insanity or mental derangement is truly, in most cases, a form of human degeneracy, a phase in the working out of it; and, if we were to suffer this degeneracy to take its course unchecked through generations, the natural termination would be sterile idiocy and extinction of the family. A curious despot would find it impossible, were he to make the experiment, to breed and propagate a race of insane people; Nature, unwilling to continue a morbid variety of the human kind, would bring his experiment to an end by the production of sterile idiocy. If man will but make himself the subject of serious scientific study, he shall find that this working out of degeneracy through generations affords him a rational explanation of most of those evil impulses of the heart which he has been content to attribute to the wiles and instigations of the devil; that the evil spirit which has taken possession of the wicked man is often the legacy of parental or ancestral error, misfortune, or wrong-doing. Let me illustrate by an example the nature and bearing of this scientific study.

I will take for this purpose a case which every physician who has had much experience must have been asked some time or other to consider and advise about: a quite young child, which is causing its parents alarm and distress by the precocious display of vicious desires and tendencies of all sorts, that are quite out of keeping with its tender years, and by the utter failure of either precept, or example, or punishment to imbue it with good feeling and with the desire to do right. It may not be notably deficient in intelligence; on the contrary, it may be capable of learning quickly when it likes, and extremely cunning in lying, in stealing, in gratifying other perverse inclinations; and it can not be said not to know right from wrong, since it invariably eschews the right and chooses the wrong, showing an amazing acuteness in escaping detection and the punishment which follows detection. It is, in truth, congenitally conscienceless, by nature destitute of moral sense and actively imbued with an immoral sense. Now, this unfortunate creature is of so tender an age that the theory of satanic agency is not thought to offer an adequate explanation of its evil impulses; in the end everybody who has to do with it feels that it is not responsible for its vicious conduct, perceives that

punishment does not and can not in the least reform it, and is persuaded that there is some native defect of mind which renders it a proper case for medical advice. Where, then, is the fault that a human being is born into the world who will go wrong, nay, who must go wrong, in virtue of a bad organization? The fault lies somewhere in its hereditary antecedents. We can seldom find the exact cause and trace definitely the mode of its operation—the study is much too complex and difficult for such exactness at present—but we shall not fail to discover the broad fact of the frequency of insanity or other mental degeneracy in the direct line of the child's inheritance. The experienced physician seldom feels any doubt of that when he meets with a case of the kind. It is indeed most certain that men are not bred well or ill by accident any more than the animals are; but, while most persons are ready to acknowledge this fact in a general way, very few pursue the admission to its exact and rigorous consequences, and fewer still suffer it to influence their conduct.

It may be set down, then, as a fact of observation that mental degeneracy in one generation is sometimes the evident cause of an innate deficiency or absence of moral sense in the next generation. The child bears the burden of its ancestral infirmities or wrong-doings. Here, then, and in this relation, may be noted the instructive fact that just as moral feeling was the first function to be affected at the beginning of mental derangement in the individual, so now the defect or absence of it is seen to mark the way of degeneracy through generations. It was the latest acquisition of mental evolution; it is the first to go in mental dissolution.

A second fact of observation may be set down as worthy of consideration, if not of immediate acceptation, namely, that an absence of moral feeling in one generation, as shown by a mean, selfish, and persistent disregard of moral action in the conduct of life, may be the cause of mental derangement in the next generation. In fact, a person may succeed in manufacturing insanity in his progeny by a persistent disuse of moral feeling, and a persistent exercise throughout his life, of those selfish, mean, and anti-social tendencies which are a negation of the highest moral relations of mankind. He does not ever exercise the nervous substrata which minister to moral functions, wherefore they undergo atrophy in him, and he runs the risk of transmitting them to his progeny in so imperfect a state that they are incapable of full development of function in them; just as the instinct of the animal which is not exercised for many generations on account of changed conditions of life, becomes less distinct by degrees and in the end, perhaps, extinct. People are apt to talk as if they believed that insanity might be got rid of were only sufficient care taken to prevent its direct propagation by the marriages of those who had suffered from it or were likely to do so. A vain imagination assuredly! Were all the insanity in the world at the present time clean swept

away to-morrow, men would breed it afresh before to-morrow's to-morrow by their errors, their excesses, their wrong-doings of all sorts. Rightly, then, may the scientific inquirer echo the words of the preacher, that however prosperous a man may have seemed in his life, judge him not blessed before his death; for he shall be known in his children: they shall not have the confidence of their good descent. In sober truth, the lessons of morality which were proclaimed by the prophets of old, as indispensable to the stability and well-being of families and nations, were not mere visions of vague fancy; founded upon actual observation and intuition of the laws of nature working in human events, they were insights into the eternal truths of human evolution.

Whether, then, man goes upward or downward, undergoes development or degeneration, we have equally to do with matters of stern law. Provision has been made for both ways; it has been left to him to find out and determine which way he shall take. And it is plain that he must find the right path of evolution, and avoid the wrong path of degeneracy, by observation and experience, pursuing the same method of positive inquiry which has served him so well in the different sciences. Being preëminently and essentially a social being, each one the member of one body—the unit, that is, in the social organism—the laws which he has to observe and obey are not the physical laws of nature only, but also those higher laws which govern the relations of individuals in the social state. If he make his observations sincerely and adequately in this way, he can not fail to perceive that the laws of morality were not really miraculous revelations from heaven any more than was the discovery of the law of gravitation, but that they were essential conditions of social evolution, and were learned practically by the stern lessons of experience. He has learned his duty to his neighbor as he has learned his duty to nature; it is implicit in the constitution of a complex society of men dwelling together in peace and unity, and has been revealed explicitly by the intuition of a few extraordinary men of sublime moral genius.

As it is not a true, it can not be a useful, notion to foster that morality was the special gift to man, and is the special property of any theological system, and that its vitality is bound up essentially with the life of any such creed. The golden rule of morals itself—"Do unto others as ye would have others do unto you"—was perceived and proclaimed long before it received its highest Christian expression.* It is not, indeed, religious creed which has invented and been the basis of morality, but morality which has been the bulwark

* There appears to be no doubt that Confucius, among others, had the clearest apprehension of it and expressly taught it; and the Buddhist religion of perfection is certainly founded upon self-conquest and self-sacrifice. They are its very corner-stone: the purification of the mind from unholy desires and passions, and a devotion to the good of others, which rises to an enthusiasm for humanity, in order to escape from the miseries of

of religions. And as a matter of fact it is certain that morality has suffered many times not a little from its connection with theological creeds; that its truths have been appropriated and used to support demoralizing superstitions which were no part of it; that doctrines essentially immoral have been even taught in the name of religion; and that religious systems, in their struggles to establish their supremacy, have oftentimes shown small respect to the claims of morality. Had religion been true to its nature and function, as wide as morality and humanity, it should have been the bond of unity to hold mankind together in one brotherhood, linking them in good feeling, good will, and good work toward one another; but it has in reality been that which has most divided men, and the cause of more hatreds, more disorders, more persecutions, more bloodshed, more cruelties, than most other causes put together. In order to maintain peace and order, therefore, the state in modern times has been compelled to hold itself practically aloof from religion, and to leave to each hostile sect liberty to do as it likes so long as it meddles not by its tenets and ceremonials with the interests of civil government. Is it not, then, fortunate for the interests of morality that it is not bound up essentially with any form of religious creed, but that it survives when creeds die, having its more secure foundations in the hard-won experience of mankind?

The inquiry which, taking a sincere survey of the facts, finds the basis and sanction of morality in experience, by no means arrives in the end at easy lessons of self-indulgence for the individual and the race, but, on the contrary, at the hardest lessons of self-renunciation. Disclosing to man the stern and uniform reign of law in nature, even in the evolution and degeneracy of his own nature, it takes from him the comfortable but demoralizing doctrine that he or others can escape the penalty of his ignorance, error, or wrong-doings either by penitence or prayer, and holds him to the strictest account for them. Discarding the notion that the observed uniformity of nature is but a uniformity of sequence at will, which may be interrupted whenever its interruption is earnestly enough asked for—a notion which, were it more than lip-doctrine, must necessarily deprive him of his most urgent motive to study patiently the laws of nature in order to conform to them—it enforces a stern feeling of responsibility to search out painfully the right path of obedience and to follow it, inexorably laying upon man the responsibility of the future of his race. If it be most certain, as it is, that all disobedience of natural law, whether physical or moral, is avenged inexorably in its consequences on earth, either upon the individual himself, or more often, perhaps, upon oth-

this life and to attain to a perfect moral repose. "Let all the sins that have been committed fall upon me, in order that the world may be delivered," Buddha says. And of the son or disciple of Buddha it is said: "When reviled he revileth not again; when smitten he bears the blow without resentment; when treated with anger and passion he returns love and good-will; when threatened with death he bears no malice."

ers—that the violated law can not be bribed to stay its arm by burnt-offerings nor placated by prayers—it is a harmful doctrine, as tending directly to undermine understanding and to weaken will, to teach that either prayer or sacrifice will obviate the consequences of want of foresight or want of self-discipline, or that reliance on supernatural aid will make amends for lack of intelligent will. We still pray half-heartedly in our churches, as our forefathers prayed with their whole hearts, when we are afflicted with a plague or pestilence, that God will "accept of an atonement and command the destroying angel to cease from punishing"; and when we are suffering from too much rain we ask him to send fine weather, "although we for our iniquities have worthily deserved a plague of rain and waters." Is there a person of sincere understanding who, uttering that prayer, now believes it in his heart to be the successful way to stay a fever, plague, or pestilence? He knows well that, if it is to be answered, he must clean away dirt, purify drains, disinfect houses, and put in force those other sanitary measures which experience has proved to be efficacious, and that the aid vouchsafed to the prayer will only be given when these are by themselves successful. Had men gone on believing, as they once believed, that prayer would stay disease, they would never have learned and adopted sanitary measures, any more than the savage of Africa who prays to his fetich to cure disease does now. To get rid of the notion of supernatural interposition was the essential condition of true knowledge and self-help in that matter.

Many persons who could not confidently express their belief in the power of prayer to stop a plague or a deluge of rain, or who actually disbelieve it, still have a sincere hold of the belief of its miraculous power in the moral or spiritual world. Nevertheless, if the matter be made one simply of scientific observation, it must be confessed that all the evidence goes to prove that the events of the moral world are matters of law and order equally with those of the physical world, and that supernatural interpositions have no more place in the one than in the other; that he who prays for the creation of a clean heart and the renewal of a right spirit within him, if he gets at last what he prays for, gets it by the operation of the ordinary laws of moral growth and development, in consequence of painstaking watchfulness over himself and the continual exercise of good resolves. Only when he gets it in that way will he get the benefit of supernatural aid; and, if he rests in the belief of supernatural aid, without taking pains to get it entirely in that way, he will do himself moral harm; for if he can not rely upon special interpositions in the moral any more than in the physical world, if he has to do entirely with those secondary laws of nature through which alone the supernatural is made natural, the invisible visible, it needs no demonstration that the opposite belief can not strengthen, but must weaken, the understanding and will. It is plain that true moral hygiene is as impossible to the savage who relies

upon his fetich to change his heart in answer to prayer, as sanitary science is impossible where he relies upon his fetich to stay a pestilence in answer to prayer.

So far from materialism being a menace to morality, when it is properly understood, it not only sets before man a higher intellectual aim than he is ever likely to reach by spiritual paths, but it even raises a more self-sacrificing moral standard. For when all has been said, it is not the most elevated or the most healthy business for a person to be occupied continually with anxieties and apprehensions and cares about the salvation of his own soul, and to be earnest to do well in this life in order that he may escape eternal suffering and gain eternal happiness in a life to come. The disbeliever might find room to argue that here was an instance showing how theology has taken possession of the moral instinct and vitiated it. Having set before man a selfish instead of an altruistic end as the prime motive of well-doing—his own good rather than the good of others—it is in no little danger of taking away his strongest motive to do uprightly, if so be the dead rise not. Indeed, it makes the question of the apostle a most natural one: "If, after the manner of men, I have fought with beasts at Ephesus, what advantageth it me if the dead rise not?" Materialism can not hesitate in the least to declare that it is best for a man's self, and best for his kind, to have fought with the beasts of unrighteousness at Ephesus or elsewhere, even if the dead rise not. Perceiving and teaching that he is essentially a social being, that all the mental faculties by which he so much excels the animals below him, and even the language in which he expresses his mental functions, have been progressive developments of his social relations, it enforces the plain and inevitable conclusion that it is the true scientific function, and at the same time the highest development, of the individual to promote the well-being of the social organization; that is, to make his life subserve the good of his kind. It is no new morality, indeed, which it teaches; it simply brings men back to that which has been the central lesson and the real stay of the great religions of the world, and which is implicit in the constitution of society; but it does this by a way which promises to bring the understanding into entire harmony with moral feeling, and so to promote by a close and consistent interaction their accordant growth and development; and it strips morality of the livery of superstition in which theological creeds have dressed and disfigured it, presenting it to the adoration of mankind in its natural purity and strength.—*Fortnightly Review.*

THE BIRTH, LIFE, AND DEATH OF A STORM.*

By ROBERT H. SCOTT, M.A., F.R.S., Etc.

WHEN we are asked to give an account of the birth of a storm, we are reluctantly compelled to admit that our storms are, almost without exception, foundlings, and that, as the precise conditions to which they owe their origin are, for the most part, shrouded in uncertainty, warm discussions at times arise as to the parish whence they have set out on their wanderings.

Dove said long ago that storms were due to the interference of the polar current or the east wind with the equatorial current or west wind. He gave the winds these names, because on his views the east winds really consisted of air flowing from the north or south pole toward the equator, which was modified in the direction of its motion by its change of latitude; while west winds were really due to air endeavoring to make its way back to the pole from the equator, whose course was in its turn modified by its moving from lower to higher latitudes. To the conflict of these two grand currents, east and west winds, Dove attributed all our storms; but he did not attempt to explain how the currents came into collision.

These views, however correct on their cosmical principles, have been superseded, of late years at least, as regards the explanation of our winds, by the modern views of the relation between the wind and the distribution of barometrical pressure; but, unfortunately, we still remain in comparative ignorance of the ultimate causes to which this distribution of pressure, or the rise and fall of the barometer, are due. To give some conception of the existing difference of opinion on these fundamental principles of our science, I may say that while some authorities maintain that the force of the wind in a hurricane is caused by the amount of barometrical disturbance which accompanies it, others hold that the fall of the barometer at the center is itself, in great measure, due to the centrifugal force of the revolving mass of air.

Of the various theories which have been propounded to account for storms, which are generally more or less cyclonic in their character, I shall only mention four:

1. Some authorities, and among them our own countryman the Rev. Clement Ley, attribute the formation and subsequent progress of a storm to the condensation of moisture, but they apparently ignore the fact that many of our very heaviest rains do not give rise to cyclonic disturbances of serious character. For instance, when on April 10 and 11, 1878, 4·6 inches of rain fell at Haverstock Hill, we had no

* Founded on a lecture delivered by the author at the London Institution, February 3, 1879.

storm of wind at all. In partial confirmation of this view, Professor Mohn, of Christiania, points to the accidental condensation of moisture caused by the contact of a mass of damp air with the surface of an extensive snow-field as a possible cause of a storm. About the sixty-first parallel of latitude the glacier region of Justedal stretches for several miles along the coast of Norway, and this has occasionally been known to exert an influence in increasing the intensity of an existing cyclone, and even in some instances has appeared as the center of a newly-formed depression.

These gentlemen, moreover, rely greatly on the fact that the rain area which accompanies every cyclonic system is roughly oval in shape, with its longer axis extending in the direction in which the system is advancing, and that by far the greatest amount of rain falls in front of the storm. They do not, however, explain the fact that very heavy rain frequently occurs on the northern side of a depression, where the wind is easterly, and that this circumstance does not indicate a northward motion of the system.

The most serious objection to this theory is, however, that first stated, that not only do the heaviest rains not come with the severest storms, but that frequently they are observed in times of nearly absolute calm.

2. The second theory to which I shall refer is the mechanical one, most strongly urged by Mr. Meldrum, of the Mauritius, whose investigations into the weather over the Indian Ocean have led him to the belief that every cyclone is generated in the intervening space between two oppositely flowing currents of air, of which the easterly moving stream, speaking in the most general terms, lies on the polar side of the westerly wind. Such a disposition of the currents would be that which would naturally arise were the cyclone once formed.

This view is called seriously in question by Messrs. Blanford and Eliot in their discussion of recent cyclones in the Bay of Bengal, which they have been able to study from very early stages, and in which they fail to see evidence of the preëxistence of two, and only two, determinate currents.

Another serious objection to this theory is that it does not assign a *vera causa* sufficient to give the *first* impetus to the barometrical fall and the rotatory movement of the air.

3. A third theory of the origin of these storms is that which is strongly urged by M. Faye, in Paris, and is to the effect that, as interfering currents in rivers give rise to vortices which extend from the surface downward into the water, so all our water-spouts, *trombes*, and even the largest tropical hurricanes must be all formed in the upper regions of the atmosphere, and extend downward to the earth: the force which gives them their onward motion being supplied by the upper currents.

It is sufficient to say that this theory has not met with acceptance

from any practical meteorologist, while it is directly controverted by recent investigations into the motion of cirrus clouds, which show beyond a doubt that the motion of the upper currents of air over a cyclone is outward, and not inward, as the descending theory would demand.

Moreover, some of our readers may have noticed, in "Nature" of January 16th, a notice, copied from the "Times," of the formation on the Lake of Geneva, on January 2d, of a veritable small water-spout, forty feet high and ten yards in circumference, by the meeting of two winds, known locally as the *Föhn* and the *Bise*, on the surface of the lake. Here the water-spout was raised, and did not descend from the clouds.

4. The last theory we shall notice is that of the late Mr. Thomas Belt, who seeks for the origin of the disturbance on the ground, and, like M. Faye, assigns the same explanation to the smallest dust-whirl eddies and the largest storms which sweep over the earth.

This theory assumes as the first cause the heat of the sun. The heat-rays pass through the atmosphere without warming the upper strata, and so Mr. Belt supposed that over a sandy soil a mass of air close to the ground might rise in temperature much higher than the superincumbent layers of the atmosphere. The lower strata would therefore become lighter, and a condition of unstable equilibrium would arise. This, however, could not last for ever, and, sooner or later, the heated lower air would burst up, and the ascending column thus produced would be the nucleus of the nascent cyclone.

The difficulty in accepting this explanation is, that we should like some ocular evidence of such a sequence of conditions. The supporters of the theory, however, point to accredited instances of the formation of whirlwinds over volcanoes like Santorin, and over extensive fires like those of Carolina canebrakes.

In confirmation of these views of the effect of solar heat in producing a depression, I may cite an investigation by Dr. Hamberg, of Upsala, who has found that in July, 1872, after a prevalence of intensely warm weather in southern Sweden, pressure gave way over the heated area, the isobaric lines following the trend of the coast; and a rotatory movement was thereby generated in the atmosphere above it, resulting in a perfectly formed cyclone which passed on over northern Finland. It would appear, therefore, that the production of a cyclonic disturbance may be attributable to more than one agency, as all the theories mentioned have some facts in their favor.

Leaving, then, this abstruse and imperfectly understood line of inquiry, let us proceed to a subject which yields us results of more immediate practical utility: the character and history of the storms when they have once started on their travels. I shall commence by saying that a greater mistake can not be made than to assert that *all* storms are distinctly connected with cyclonic disturbances.

The force of the wind depends on differences of atmospherical pres-

sure over a given area, and the only reason why storms are generally associated with cyclones is that these systems afford us the most serious instances of disturbances of atmospheric equilibrium, and consequently of differences of pressure, which are met with on the globe.

At any place where an area of relatively high pressure comes into close proximity to an area of relatively low pressure, a gale will result, and so a storm may be due just as much to the rise of the barometer in one region as to its fall in an adjacent district. For the same physical reason, however, that the eddies in a river extend downward, and the water does not pile itself up in a peak, the normal disturbance of atmospherical equilibrium is the appearance of one of these vortices with pressure decreasing rapidly toward the center. Wherever there is a rapid decrease there is a steep gradient, and consequently a strong wind.

Defining the term cyclone, in its very widest acceptation, as indicating a region of diminished pressure, round and in upon which the air is moving along paths which are more symmetrical all round the center the more perfect is the circular form of the system, we must at once see that not every cyclone is accompanied by a storm. The fact is, that the direction and force of the wind are regulated by the difference of barometrical pressure over a given distance, and not in any way by the actual height of the barometer at the station at which the storm is felt, or by the distance of that station from the point where the barometrical reading for the time being is the lowest.

This explanation of wind-motion is almost the only new principle which has been recognized in our science during the present generation, and its practical importance is daily forcing itself more and more into public notice with the development of weather telegraphy. It is usually known under the name of Buys Ballot's Law, and is stated as follows: "Stand with your back to the wind, and the barometer will be lower on your left hand than on your right." The truth of this law is evident to any one who looks at a weather chart; but the Dutch Professor, after whom it is named, though he justly claims the credit of having persistently advocated the acceptance of this relation of the wind to the distribution of pressure, was not by any means the first to discover it.

The final result of all the inquiries into the question is, that on the mean of all winds the angle between their direction and the tangent to the isobar at the place is about 20°.

These principles of wind-motion have a most important bearing on the theory of the motion of the air in hurricanes and typhoons. The old popular idea of these phenomena is, that the air blew round and round the central calm in circles, so that any sailor caught in one of these storms could at once know that when he was hove-to, if he looked in the wind's eye, the center bore eight points to the right in the northern hemisphere, and to the left in the southern; or, what is the same

thing, if he was scudding before the wind, the center would lie exactly on the starboard beam in the northern and on the port beam in the southern hemisphere.

Modern meteorologists, however, almost with one voice, declare for a spirally incurving movement as the most probable behavior of the wind, as would be indicated by the angle which its direction makes with the isobars as just explained; but this view presents no novelty, for it was first stated about forty years ago, and Piddington, in his "Sailor's Hornbook," says that even Redfield, when propounding his "Law of Storms," stated:

"I have never been able to conceive that the wind in violent storms moved only in circles. On the contrary, a vortical movement, approaching to that which may be seen in all lesser vortices, aërial or aqueous, appears to be an essential element of their violent and long-continued action, of their increased energy toward the center of axis, and of the accompanying rain. In conformity with this view, the storm-figure on my chart of the storms of 1830 was directed to be engraved in spiral or involute lines, but this point was yielded for the convenience of the engraver."

We see, therefore, that when we trace back to its origin the belief that any storms are really circular, we find that it was "the convenience of an engraver" which decided the question.

It may be safely asserted that there does not exist, for a single instance of a West Indian hurricane or China Sea typhoon, a sufficiency of evidence to convince any unprejudiced investigator as to what was the true path of the air in the storm. To show this path beyond the possibility of doubt, we require a considerable number of simultaneous observations taken on different sides of the storm center. These, however, were not forthcoming in the case of a single storm described by Redfield, Reid, or Piddington, so that the authority of the founders of the law of storms can not be cited as decisive of the question.

This suggestion of spiral motion must of course modify the simple rule for a ship scudding, of looking in the wind's eye, and taking eight points on the starboard or port side for the storm center, and indicates the probability that the true position of that spot will be at least two or three points ahead of the bearing given by that rule, so that the ship, if scudding, *may be* gradually approaching the most dangerous part of the storm.

The recent investigations of Mr. Meldrum, which have been thoroughly confirmed by Captain Toynbee's examination of the Nova Scotia storm of August 24, 1873, lead to the suspicion, not to use a stronger word, that these cyclonic storms are not symmetrical at all, and that at some parts of the system the wind blows directly toward the center, so that for a ship in such a situation, and scudding before the wind, the center would lie right ahead.

This is a subject which requires most careful study, in order to see

whether or not the time-honored rules for handling ships in rotating storms require modification.

I shall now leave the subject of the air-motion, and proceed to describe the phenomena of a cyclonic disturbance when it passes over us. In the first place, very few of them, in these latitudes, exhibit much approach to a circular shape, as regards the course of the inner isobars, and we may say that none of them develop equal violence in all segments. The reason of these differences in the force of the wind is to be found in the distribution of pressure in the vicinity of the storm area, for if on any side of that area there exists a region of high barometer readings, on that side steep gradients will be produced, and of course proportionably great violence of the wind. The actual weather phenomena of a typical cyclonic disturbance, if plotted on a diagram, show very clearly how cloud and rain prevail over the whole front of the system, and how in the rear, where the wind is northwesterly, the sky clears up. There is one fact worth remembering about these storms, and that is, that just before the sky clears a very smart squall of rain frequently comes on; so that we get this practical hint: if, during a westerly gale, we find the rain becoming exceptionally heavy, we may look for the weather speedily to clear up.

Such a diagram also shows us that it is quite a mistake to consider all east winds as dry ones, for in a cyclonic system the cloud area extends on the northern side, where the wind is easterly, nearly as much as on the southern, where the wind is from the westward. In fact, many of our wettest days occur with easterly winds, when one of these depressions passes to the south of the station where we may be.

I shall now proceed to give a slight sketch of what we have learned of the movement of storms. This, as far as we can see, is regulated by the position of the areas of high pressure, or, as they are called, the anticyclones. This is a term introduced about fifteen years ago by Mr. Francis Galton, to indicate an area of excess of pressure out from which the air is slowly whirling with a motion opposite to that which it has in cyclones. If we find an anticyclonic area existing over any region, we know that the cyclonic disturbances will skirt round it and develop their strongest wind on the side which lies closest to the district of high pressure.

Thus if the anticyclone lies over France, the cyclonic disturbances will move from west to east over the British Isles. If the area of high pressure lies over England, the depressions will sweep outside the Scotch coast, and reach Norway north of the sixtieth parallel. If the anticyclone lies to the westward, and the pressure is higher in Ireland than in Great Britain, there is danger of northerly gales on the east coast of England, from cyclonic disturbances traveling southward over the North Sea.

In every case the cyclone moves with the prevailing wind along its track.

Unfortunately, we know very little about the rate at which these storms advance, some of them moving at the extraordinary speed of fifty or sixty miles an hour, as for instance that of March 12, 1877; while others, like the West India hurricanes, do not attain one fourth of that rapidity of translation. It is remarkable that the rate of progress bears no relation to the intensity of the storm, the slow-moving tropical hurricanes being infinitely more violent than many of our rapidly-moving disturbances; although the storm already mentioned in March, 1877, was severe enough, at least in the north of France, to satisfy any requirements.

As regards the distance which storms have been known to travel, I may cite a very long-lived storm, which lasted nearly a fortnight in August, 1873, and which was traced along its course by my friend Captain Toynbee, by means of the logs of two hundred and sixty ships which were in the Atlantic during its continuance. Its history will be found in the last published work of the Meteorological Office, "The Weather over the Atlantic Ocean during August, 1873." This particular storm wrought immense damage on the coast of Nova Scotia. It did not, however, travel as far as Europe, having disappeared in the neighborhood of Newfoundland. In fact, very few storms have really been proved to maintain their individuality during their transit. Professor Loomis, an American meteorologist, who has devoted much attention during the last twenty years to the connection between European and American weather, has very recently published a paper on the results of discussion of two years' daily synoptic charts of the Atlantic. During that interval thirty-six areas of depression were traceable across the Atlantic, that is, at the rate of eighteen a year. Testing these by wind reports from England alone, he finds that the chance that a storm center coming from the United States will strike England is only one in nine; of its causing a gale anywhere near the English coast it is one in six; while the chance of its causing a strong breeze is an even one.

This brings us to a subject which has attracted an immense amount of public attention in this country and in France: the practical value of the warnings which have been sent over by the "New York Herald" during the last two years. By "practical value" I mean the value to our fishermen and coasting sailors, for whose benefit, more than for that of seagoing men in large vessels, the whole system of storm-warnings has been called into being. It is evident that a warning which is locally unfulfilled may mean a loss of some hundreds of pounds to a fishing fleet; and although the storm to which it referred may have reached some parts of the coasts of Europe, yet if it did not visit the precise district where the fishing was being prosecuted at the time, the fishermen in that district were not benefited by the warning. On the contrary, they were the worse for having received it, on the old principle that "Wolf! wolf!" should not be cried too often.

Of course, every word that I here say as to the usefulness of warnings is just as true with reference to warnings issued by our own office in London as to those of the "New York Herald," but these latter are often very general in their scope. They speak occasionally of a storm reaching the British Isles and France, and affecting Norway. This haul of the net embraces 25° of latitude, from 45° to 70°, and it is an unheard-of thing that a gale should prevail simultaneously over such an immense tract of coast, so that on each occasion the seamen in many harbors can not derive immediate benefit from the publication of so vague an announcement.

It is one thing for a scientific man to say that he can recognize the presence of the predicted cyclone on our coast—Professor Loomis admits that the chances are even that he should do so—but it is a totally different matter to prove that a gale which begins two days before or two days after the time of a predicted storm, is really the very disturbance which left the American coasts.

The experience of those who have studied cyclone tracks in northern Europe shows that in winter, on an average, a cyclonic disturbance visits some parts of those regions every fourth day, so that, if a warning were announced once a week regularly, there would be nearly a certainty of some sort of a fulfillment.

The results of a most careful comparison of these warnings with the weather experienced by us during the years 1877–'78 are given by the following percentage figures:

	1877		1878	
Absolute success	17·5	42·5	27·0	45·0
Partial success	25·0		18·0	
Partial failure	15·0	57·5	10·0	55·0
Absolute failure	42·5		45·0	

In order to obtain so favorable a result as forty-five per cent. of general success, great allowances have been made. Thus it has been considered an absolute success if a gale was felt on *any* part of the coast, whereas the prediction was for *all* parts; and when three separate storms were predicted in one telegram, none of which arrived, only one failure has been counted.

It is, therefore, pretty clear that these warnings have not, as yet, proved themselves to be of much practical utility to our coasting trade and our fishermen. The question is a most interesting one, and although a satisfactory solution of it has not been attained, we need not despair; but we should attack it from the scientific side, and discuss the results in a calm, dispassionate spirit, and through some other medium than that of letters to newspapers.

Let us now leave these American warnings, and see what we know about the movement of storms over western Europe, which is the problem which most immediately concerns us here. The illustration has often been used that meteorologists, in issuing storm-warnings, and

having to estimate the direction and rate of motion of every storm the instant it shows itself in their neighborhood, are in the position of astronomers expected to assign the path of a comet from the first glimpse they get of it through a break in a cloud—a problem which all will allow to be impossible of solution. Accordingly, great interest attaches to the attempts made from time to time to lay down principles for forecasting the motion of the disturbance.

I have already stated that, as a general rule, the cyclones move round the anticyclones; but this principle requires for its application to storm-warning purposes, access to charts embracing a very considerable extent of the earth's surface. These are very difficult for Englishmen to obtain, as our own daily charts are very limited in area, and frequently do not exhibit even the whole extent of a single cyclonic depression, much less its relation to the distribution of pressure all about it. For those, however, who can consult such charts it is possible, so to speak, to take their stand at a higher point of view and survey the conditions prevailing, say over Europe, on any given day.

If the amount of change in the pressure or of rise and fall of the barometer during the preceding night be plotted every morning on such a chart, it is found that the path of the system for the day does not lie directly toward the region where the greatest fall has occurred during the night, but is regulated to a certain extent by the direction of the line drawn from the point of greatest fall to that of greatest rise.

Another theory of storm-motion, strongly held by those who attribute all our storms to condensation of vapor, is that the track of the depression is always directed toward the region where the air is dampest. This principle, like that just noticed, can hardly be turned to account in this country for our own practical benefit, inasmuch as the whole of these islands appear to be almost equally damp, owing to the proximity of most of our telegraphic reporting stations to the sea.

Other suggestions have been made in various quarters, with the view of throwing light on this very important subject; but we can not say that the results have met with general acceptance, and the matter urgently demands further study.

I must now come to the final portion of my theme—the death of a storm; and on this subject, unfortunately, I have very little to say. As we have not been able to produce evidence of the birth of a storm, so have we never been lucky enough to find any one who was in at the death. In fact, some French meteorologists have hazarded the statement that storms can travel all round the world until at last they travel off it.

Storms have been traced from the Pacific coast of North America across the Atlantic; but these instances are necessarily rare, and, as far as European experience goes, no storm arriving from the Atlantic ever travels far into Russia. This fact is, of course, very much in favor of the condensation theory of storm generation, which has already

been noticed. The advocates of this view plead very plausibly that, as the moisture in the air is the food of the storm, so, where that moisture is deficient, the storm dies of starvation.

We may, however, point out to them that eddies in a river and dust-whirls at street corners waste and wane without any assistance from vapor condensation.

In conclusion, though it is a humiliating confession for us to make, meteorologists are as yet entirely in the dark as to the reasons why one depression fills up while another becomes deeper. As I have already stated, no meteorologist is able to give a straightforward answer to the simple question, What causes the barometer to rise or fall?—*Popular Science Review.*

BIOGRAPHICAL NOTICE OF GEORGE F. BARKER.

PROFESSOR BARKER, who is this year President of the American Scientific Association, was born in Charlestown, Massachusetts, July 14, 1835. His parents were in comfortable circumstances, his father being in command of a packet-ship sailing between Boston and Liverpool. His early education was received in the public schools of his native place, though before graduating at the high school the family removed in 1849 to South Berwick, Maine, and he continued his studies, first at the Classical Academy in that village, and subsequently at the Lawrence Academy in Groton, Massachusetts, and at Yarmouth Academy, Maine. In 1851 he accepted an invitation from his father to visit the Crystal Palace International Exhibition in London. On his return he entered, as an apprentice, the shop of the Hon. J. M. Wightman, of Boston, the well-known maker of philosophical instruments, where he remained until he attained his majority in 1856. Faraday was not so fortunate; he was an apprentice to a bookbinder, whereas young Barker was indentured to a trade that laid the foundation of his scientific education.

In September of that year, by the advice of friends, he entered the Yale Scientific School (now the Sheffield School) in New Haven as a student in chemistry, and was graduated therefrom with the degree of Bachelor of Philosophy in 1858. During the last year of this course of study he held the position of Professor Silliman's chemical assistant; and during the winter of 1858–'59, and again in 1860–'61, he was assistant to Dr. John Bacon, Professor of Chemistry in the Harvard Medical School, Boston. In 1859, at the Springfield meeting, he was made a member of the American Association for the Advancement of Science. In the winter of the same year he gave, on invitation, a course of public lectures in the city of Pittsburg, under the

auspices of the Western University of Pennsylvania. In the summer of 1860 he again visited Europe, spending his time while abroad mainly in studying the scientific collections, institutions, and resources of London and Paris.

During the month of August, 1861, on the recommendation of his friend President Hitchcock, of Amherst College, he was tendered the professorship of Natural Science in Wheaton College, Illinois. This he accepted, and discharged the duties of the chair for the subsequent college year. In September, 1862, he went to Albany, at the solicitation of his friend Professor C. H. Porter, to act as his substitute in the chair of Chemistry in the Albany Medical College, Professor Porter having entered the army as Assistant Surgeon of Volunteers. While thus acting, he pursued regularly his medical studies, and was graduated therefrom as a Doctor of Medicine in 1863. After a third course of chemical lectures in Albany, given in the fall of 1864, Professor Barker went to Pittsburg as Professor of Natural Science in the Western University, remaining there during one year.

In the winter of 1865–'66, while preparing to enter the service of the United States as an Assistant Surgeon of Volunteers, having been offered a commission by Dr. Quackenbush, then Surgeon-General of the State of New York, he was offered by Professor Silliman the position of Demonstrator of Chemistry in the Yale Medical College. This offer was accepted, and he entered immediately upon his duties. Early in the spring of 1866 Professor Barker wrote the first part of a text-book, intended as a new edition of Silliman's "Chemistry." In this book, the modern nomenclature and notation appeared in a text-book for the first time in this country. The theory of types was made use of as a basis of classification, and the book was used with the senior class in Yale College.

During the absence of Professor Silliman in California in 1866–'67, the entire instruction in chemistry, in the Academical Department of Yale, was given by Dr. Barker. At the commencement in 1867, he was appointed Professor of Physiological Chemistry and Toxicology in the Medical Institution of Yale College. The chemical lectures in Williams College, in the absence of an instructor in that science, were given by him in the spring of the years 1868 and 1869. In the summer of 1870 he wrote a chemical manual entitled "A Text-book of Elementary Chemistry," which was published in September. In this book it was assumed that one philosophy was broad enough for the whole of chemical science; and hence the subject was divided into four sections—Theoretical, Inorganic, Organic, and Physiological—only the first two of which were presented in the volume mentioned. It achieved a very considerable success, about ten thousand copies having been sold within the five years after its publication, and translations of it into French and into Japanese having been made. It was adopted as the text-book in the University of Tokio, Japan. In

December, 1871, Professor Barker delivered a lecture before the American Institute in New York, upon the "Correlation of Vital and Physical Forces," which attracted very general attention. The lecture was an attempt to show that, besides the ordinary psychological definition of mind, another and a purely physiological one might be found, which represented mind as solely the product of brain-action, and, as such, entirely capable of being correlated with physical forces. In 1872 he was Vice-President of the American Association at its Indianapolis meeting.

Having made the branch of toxicology the subject of special study, Professor Barker was engaged quite generally in the investigation of cases of criminal poisoning. Perhaps the most important of these cases was the celebrated one in which Lydia Sherman was tried in New Haven, in April, 1872, for poisoning her husband with arsenic. Because the Wharton case, tried just before, had apparently left upon the public mind the impression that chemical analysis in such cases was unreliable, and hence had given the criminally disposed some reason to believe that they might commit murder by poison with impunity, especial care was taken by Dr. Barker to present the chemical and physiological evidence in the Sherman case in a fully conclusive form. To the thoroughness of this preparation, and the completeness of the chemical evidence, the conviction of the prisoner was largely due. The chemical evidence in this trial, after correction by him, was inserted in full, as a typical case, in the subsequent edition of Wharton and Stillé's "Medical Jurisprudence."

In February, 1873, he was strongly urged to accept the chair of Physics in the University of Pennsylvania, Philadelphia. After due consideration and consultation the offer was accepted, and he removed from New Haven to Philadelphia in April. The trustees having placed a generous sum of money at his disposal, for the purpose of providing the apparatus necessary for illustrating the science in a proper manner, Professor Barker left in July for Europe, in order to personally inspect the instruments he was about to purchase. The result has justified this step. The collection of physical apparatus in the university cabinet is certainly unsurpassed in this country, and in some directions it is absolutely unique in the world.

In the fall of 1876 Professor Barker had the distinguished honor of being elected a member of the National Academy of Sciences. In the summer of 1878, on invitation of Professor Henry Draper, he accompanied the Draper Eclipse Expedition to Rawlins, Wyoming, where he studied the total solar eclipse of July 29th, as spectroscopic observer. The most important fact obtained by him was the confirmation of Janssen's observation of 1871, that the coronal spectrum contained the dark solar lines of Fraunhofer. After the eclipse he accompanied his friend Thomas A. Edison on a trip to California and the Yosemite. He stopped on his return to attend the meeting of the

American Association for the Advancement of Science, held at St. Louis. He was there elected President of the Association for the next meeting, to be held at Saratoga, August 27, 1879.

Professor Barker has well earned his distinctions, but he is to be congratulated on having also obtained them. He has been the recipient of many deserved honors, and now, in middle life, after a twenty years' membership, he is called upon to preside over the deliberations of the largest scientific body in the country, and to fill the chair that has been occupied by all of our ablest scientific men.

Professor Barker manifested at a very early age a taste for the sciences which he has subsequently cultivated so successfully. While yet a boy he was intrusted with the apparatus belonging to the academies where he was at school, and converted his sleeping-room into a chemical laboratory. As an apprentice he extended his acquaintance with instrumental appliances, and constructed for himself in his leisure hours a very complete set of electrical and pneumatic apparatus. The familiarity with the use of tools, and the knowledge of the construction of instruments thus acquired, have no doubt been of the greatest practical benefit to him in subsequent life. Indeed, it is said that, when he went to Pittsburg as professor, much of the apparatus placed in his hands for purposes of instruction was the identical apparatus which he had made in Boston as an apprentice ten or twelve years before. Though upon his graduation from Yale he made chemistry his profession, turning his attention more particularly to its physiological relations after taking his doctor's degree, he yet kept up his interest in physics, especially in the departments of electricity and spectroscopy, until upon his removal to Philadelphia he made physics the subject of his instructions, though still keeping up his knowledge of chemistry.

Professor Barker's reputation as a chemist rests chiefly upon his work in chemical theory, he having been among the first in this country to appreciate the advantages of the new views, to use them in his own work, and to teach them to his students. In physics his spectroscopic work upon the metals, upon auroras, and upon the phenomena of solar eclipses has been of high scientific value. But it is as an instructor in science that the chief part of his time has been spent. Not only in the class-room and the laboratory with his students, but also in the public lecture-room, and before the largest audiences, has his power of elucidation and illustration gained for him preëminence. He has served as scientific expert in a number of noted patent cases. He has acted as one of the chemical editors of the "American Journal of Science and Arts" since July, 1877, having prepared the abstracts of chemical papers which were published in that Journal since 1868. He was editor of the "Journal of the Franklin Institute" during 1874–'75; and he prepared, at the request of Professor Baird, the chemical and physical notes for the "Scientific Rec-

ord" of "Harper's Magazine," and for the "Annual" for many years. We subjoin a list of the most important of the scientific papers which he has published :

1. "The Forces of Nature"; a Lecture before the Chemical Society of Union College. (Albany, 1863.)

2. "Account of the Casting of a Gigantic Rodman Gun at Pittsburg" (American Journal of Science, II., xxxvii., 296, April, 1864).

3. "Report of a Trial for Poisoning by Strychnia" (American Journal of Medical Sciences, October, 1864).

4. "Formic *versus* Carbonous Acid" (American Journal of Science, II., xliv., 263, October, 1867).

5. "On Normal and Derived Acids" (American Journal of Science, II., xliv., 384, November, 1867).

6. "A Text-book of Elementary Chemistry, Theoretical and Inorganic" (New Haven, 1870).

7. "Notices of Papers in Physiological Chemistry" (American Journal of Science, II., xlvi., 233, 379; xlvii., 20, 258, 393; xlviii., 49).

8. "Abstract of the Second Series of Meissner's Researches on Electrized Oxygen" (American Journal of Science, II., l., 213, September, 1870).

9. "On Molecular Classification" (American Chemist, i., 359, April, 1871).

10. "On the Rational Formulas of the Oxides of Chlorine and of Oxides analogously constituted" (American Chemist, ii., 1, July, 1871).

11. "Note on the Spectrum of the Aurora" (American Journal of Science, III., ii., 465, December, 1871).

12. "Correlation of Vital and Physical Forces"; a Lecture before the American Institute. (New York, 1871.)

13. "The Chemical Testimony in the Sherman Poisoning Case" (American Chemist, ii., 441, June, 1872).

14. "On the Spectrum of the Aurora of October 14, 1872" (American Journal of Science, III., v., 81, February, 1873).

15. "A New Vertical Lantern Galvanometer" (Proceedings of the American Philosophical Society, xiv., 440, May, 1875).

16. "The Molecule and the Atom"; an Address to the Chemical Subsection of the American Association for the Advancement of Science, at the Buffalo meeting (Proceedings of the American Association for the Advancement of Science, xxv., 85, August, 1876).

17. "Results of the Spectroscopic Observation of the Solar Eclipse of July 29, 1878"; a Report to the Director, Dr. Henry Draper (American Journal of Science, III., xvii., 121, February, 1879).

18. "On a New Method of measuring the Pitch of a Tuning-Fork" (Proceedings of the American Association for the Advancement of Science, xxvii., 118, August, 1878).

19. "On the Total Solar Eclipse of July 29, 1878" (Proceedings of the American Philosophical Society, xviii., 103, November, 1878).

CORRESPONDENCE.

A COMPLAINT ABOUT THE MONTHLY.

Messrs. Editors.

WILL you permit a brief criticism of your selections for "The Popular Science Monthly"? My appreciation of the journal is sufficiently indicated in its reception and careful reading from the time it was begun. I have for some fifty years tried to do my own thinking—not so self-sufficiently, however, that I am not very glad to get what true help I can from other thinkers.

I have been attracted to "The Popular Science Monthly" by the evident desire and purpose of its conductors to give a fair hearing to all views, *pro* or *con*, on any subject of general scientific interest. There is one, however, now before the world which, in importance to the whole human family, can be assigned to no second place, which, in my view, you treat in a very partisan manner. I refer to the Harmonial Philosophy, Spiritualism, or whatever it may be called. This question, whether evolving truths of the deepest importance to humanity, or a species of insanity, delusion, or imposition, demands attention and discussion; for millions of people are to-day affected more or less by its phenomena and teachings, and it is spreading with a rapidity unrealized by the indifferent observer. From its first opening with the Fox girls near Rochester, New York, to the present, I have observed it closely, and often under very favorable circumstances. To endorse it *en masse* would to me be folly; to utterly ignore it, equally so.

I am fully satisfied that there are great and most important truths involved in the subject, which demand elimination from what may be accompanying rubbish. Now, when you select for "The Popular Science Monthly" articles all, or nearly so, on one side of this question, and from men like Hammond, Beard, Gairdner, Trowbridge, etc., you leave the path of true science for that of the partisan.

To me, as well as several other readers of the journal with whom I have communicated, a *fair* discussion of this subject would not only add interest, but remove a present offense. You might lose some bigoted and fossilized readers, but you would gain an equal if not larger number of the less prejudiced.

A. L. CHILD, M. D.

PLATTSMOUTH, NEBRASKA, *May* 30, 1879.

"WASTED FORCES."

Messrs. Editors.

IN an article on "Wasted Forces" by William H. Wahl, Ph. D., in "The Popular Science Monthly" for July, 1879, I note some remarkable statements in that part of the article which deals with the efficiency of steam-engines. The writer seems to have ignored the principal cause of wasted heat in the steam-engine, viz., the efficiency of the fluid, and to have augmented the other losses in order, apparently, to account for the low efficiency of the whole machine. In doing this he has given figures, which not only leave wrong impressions in the minds of those not familiar with the subject, but he makes opportunities for improvement seem far greater in some directions than they are. I do not care to call in question the fifteen per cent. which Mr. Wahl gives as the greatest efficiency yet obtained from steam-engines, but in locomotive-engines, with which I am most familiar, five per cent. will more nearly represent the efficiency of average performance. Granting that fifteen per cent. may be obtained in the most economical engines, it is to Mr. Wahl's method of accounting for the loss of eighty-five per cent. that I object. On page 292 one reads: "For by far the greater portion of this eighty-five per cent. of wasted power is chargeable directly to the steam-boiler, and but a comparatively small proportion thereof to the engine." And again, on page 293: "Summing up all the items of loss in the steam-generator, it is probable that with the best forms of boiler which it has been possible to construct, not more than twenty-five per cent. of the theoretical thermal effect of the fuel is utilized in the generation of steam; and of this twenty-five per cent., from five to ten per cent. is lost somewhere on the passage of the steam from the boiler to and through the engine by condensation in steam-pipes, and friction of the machinery, leaving us but fifteen or twenty per cent. actually realized in practice." As a matter of fact I have repeatedly observed from fifty to fifty-five per cent. of the total theoretical number of heat-units obtainable from the complete combustion of bituminous coal transferred to the water and steam in the boiler from locomotive fire-boxes, in which the proper burning of coal is far more difficult than in stationary fire-boxes, or those with natural draught and ample room; in such fire-boxes as last mentioned, coal is

burned so as to transfer from seventy to seventy-five per cent. of its theoretical heat to the boiler, and I do not know that this is the best attainable. Mr. Wahl's limit of twenty-five per cent. efficiency of fire-box, or, as he well terms the boiler and fire-box, the "steam-generator," is therefore entirely too low; neither has he mentioned the principal cause of the loss of heat in steam-engines, viz., the low efficiency of steam as a medium on account of its high latent heat, a very small part of which, at best, can be utilized even in condensing engines, and still less in non-condensing engines. In locomotive-engines the following statement will represent a fair average performance, with corresponding approximate rates of loss from different causes:

Efficiency of steam-generator.....	55 per ct.
Efficiency of steam and steam-engine.	8 "
Efficiency of machine .55 × .8=.....	4.4 "

The low efficiency of the steam stands somewhat as follows:

Units of heat required to convert one pound of water from 60° Fahr. to steam at 125 pounds' pressure.....	1,160
Of which the latent heat is.....	865

which can not be converted into work in the locomotive-engine: neither is the difference 1,160 − 865 = 295 all available; for 212 − 60 = 152 of this was required to heat the pound of water to the boiling-point at atmospheric pressure, and still more at one hundred and twenty-five pounds' pressure. This reduces to 295 − 152 = 143 units, all of which is not obtained from each 1,160 units expended, for the steam is exhausted at some pressure above atmosphere to get more work from the engine and to blow the fire, so that we really get but about ninety useful units out of 1,160 expended, or about eight per cent. In best stationary engines (which are to yield fifteen per cent. efficiency) this would stand:

Efficiency of generator, approx...	75 per cent.
Efficiency of steam and engine "	20 "
Efficiency of whole machine, .75 × .20=15	"

The twenty per cent. here in place of the eight per cent. in locomotives is because of expanding steam to a lower pressure before exhausting, of the partial vacuum ahead of piston from condensing exhaust steam, and of the heated feed-water which should be credited to this account of efficiency of steam. I can not here go into the experiments of M. Hirn, and conclusions therefrom, on the beneficial influence of partial condensation on steam side of piston, but the above figures, so far as they go, will nearly represent the facts of efficiency. I think you will do your readers a service by correcting, even in this general way, the wrong impressions they may have received from Mr. Wahl's figures.

JOHN W. CLOUD.

ALTOONA, PENNSYLVANIA, *July* 5, 1879.

A WONDERFUL PHENOMENON ACCOUNTED FOR.

Messrs. Editors.

I SEE by your correspondence that there is some interest taken in spiritualism.

A case occurred in my experience some fifteen years ago which, for a while, made a profound impression on my mind. My house is situated about three hundred feet from a large church, which has a fine organ, that we heard more or less, when played upon.

It was in the beginning of summer; the windows being open, myself and family heard more plainly than common, as we thought at first, the organ. It went through a chord producing at times what is called the *tremolo*. We soon ascertained, however, that these sounds did not come from the organ, but from the piano which stood in our double parlors. It went through a chord of quite a number of the lower notes, giving somewhat the sound of the organ. Being myself rather skeptical in matters pertaining to superhuman phenomena, I was touched profoundly by these manifestations.

Some of the more timid neighbors declared they would not live in the house; myself and family did not share these views. I stated to my friends that I expected to find some rational cause for this most extraordinary phenomenon. People wanted to come in droves to witness this new wonder, which I did not allow. Some spiritualists came from Boston, ten miles, to hear for themselves, and declared it must be produced by spirits from the other world. To this I could not assent, never having believed in spiritualism.

The Rev. Eli Fay, Unitarian, and now settled at Sheffield, England, and the Rev. Dr. J. C. Bodwell, Orthodox, now dead, both able, discreet men, spent with me considerable time in investigating the cause of these wonderful sounds. They examined the house throughout, including the cellar, without success. On one occasion one of my neighbors, being present, made the inquiry, "Who have played most on your piano, who are now dead?" My answer was, his own wife, now dead, and the daughter of one of my near neighbors. He then replied, "Is it possible that Caroline's spirit" (meaning his wife) "is there?"—when the piano seemed to go through a chord louder than ever before, and almost made the hair stand erect on our heads.

And so it continued for some days, until one evening I sat on the front stairs reading the evening paper, there being no gas burning in the house except in the hall, and my family were out. My attention was attracted to a very different sound, not musical, coming apparently from the piano. I stepped into the parlors—still the noise continued. I now lighted the gas in the parlors, when im-

mediately the original harmony was renewed. It now occurred to me that the gas must produce some vibratory effect upon the strings of the piano and therefore was the cause of these extraordinary sounds. In support of this the sounds were heard only in the evening, which gave the whole affair an additional strangeness.

This proved to be the key that unlocked the whole mystery. I soon found the piano had nothing to do with it, notwithstanding myself and friends had repeatedly listened at the piano when the cover was both open and shut, and it seemed to proceed direct from the instrument. On further investigation the sounds were traced to the gas-meter which was in the cellar, nearly under the piano. The sound, though diffused somewhat, had seemed to be in the piano.

After a short time my family became tired of these sounds, and I had the gas meter changed for another, and have never heard them since.

I could have made a great sensation of this matter, but did not. I have no doubt that many mysterious things have taken place which have been ascribed to some supernatural cause, when persistent intelligent investigation would have solved the whole affair in a rational way. Truly,

JOHN CLOUGH.

WOBURN, MASSACHUSETTS, *July* 15, 1879.

EDITOR'S TABLE.

SPIRITUALISM AGAIN.

WE print a translation of Professor Wundt's letter to Ulrici, which has attracted a good deal of attention in Germany, and is quite as applicable here as there. The view taken is one that needs enforcing, and it is satisfactory to find that it completely agrees with what has been repeatedly urged upon the subject in our pages.

We print also a communication from Dr. Child, of Nebraska, complaining of our partisanship in publishing upon only one side of this subject. He asks that we give audience to the spiritualists because it is our habit to accord "a fair hearing to all views, *pro* or *con*, on any subject of general scientific interest." But he here overlooks a very important distinction. We give the *pros* and *cons* only of subjects that are within the legitimate sphere of science. We give the *pros* and *cons* of discussion only where imperfect knowledge leads to diverse views, and where both sides recognize the canons of evidence by which all science has been created. But, though admitting of controversy under this limitation, our journal is devoted to the interests of science, and it can not be denied that we *are* partisans—partisans of the multiplication-table, partisans of the law of gravity, partisans of science generally. Our magazine was started expressly to represent this side of things, and we have no right to publish the other side—that is, anti-scientific papers; it would be a breach of contract with subscribers.

Our correspondent offers as a reason why we should open our columns to spiritualism, the fact that millions of people are becoming affected by its teachings, while it is spreading with unsuspected rapidity. That is a reason which might be addressed to ambitious politicians, who are always powerfully impressed by numbers, or to sectarian adventurers looking out for recruits; but it can not weigh in the court of science, where there is but one interest, the establishment of scientific truth. To the scientific mind, spiritualism is much the same whatever its magnitude. Science is satisfied to operate on small quantities, so they are fair samples, and for its purposes, one roomful of mediums is as good as a hundred. The believers in the power of ghosts and spirits have always been in the majority, and will no doubt long continue to be so. Does not our correspondent see that this rapid extension of spiritualism links it on to popular ignorance and credulity, and cuts it off from intelligence? Does he not see that he is

dealing with the old superstition in a new form, and which spreads by the law of contagion rather than that of reason?

There are two aspects of spiritualism, one of which is entitled to the attention of scientific men and the other is not. When it is investigated by competent authorities, by men qualified for the task, it is proper to publish the results, and this we have done and are still doing. We have given more prominence in the pages of this periodical to psychical and psychological questions which involve and enwrap the phenomena of spiritualism — have published more papers bearing upon the philosophy of the subject—than any other popular magazine either in this country or abroad.

But there is another aspect of spiritualism which does not deserve the slightest regard from scientific men, and this is exactly the aspect which is most insisted upon by spiritualists. As its problems are usually presented, the man of science can not for a moment entertain them without committing intellectual suicide. Science postulates an inflexible order of nature as the foundation of all its work. It starts from this principle, and assumes it at every step, in every direction. That which makes science possible is the uniformities among the phenomena of the natural world. It is its sole business to trace out these uniformities in time and space, which form the essential fabric of nature's order. The man of science works them out and formulates them as laws. All scientific reasoning, all induction, deduction, generalization, comparison, classification, are based upon the regularity and constancy of natural operations. The first article of a scientific man's faith is that Nature never breaks her regularities, but holds true to an unalterable method of law. He knows that, if he comes upon what appear as breaks or suspensions of this order, it is he who is at fault, and that with further knowledge the apparent derangement will disappear.

Now, the spiritualist comes to him, challenging his first principles. He denies his order of nature as being unalterable, and says that he knows of that which is above nature, that is greater than nature, that interferes with it, and breaches all its vaunted stabilities with infinite ease. To this the man of science must logically reply: "I can not waste time in listening to you. I am limited to nature, you take your stand outside of it, and there is no common ground between us. You come to me denying that which I find demonstrated everywhere. Between your spiritualism and my naturalism there is a fundamental antagonism; your position is radically anti-scientific, and so let us keep clear of each other."

That such is the attitude of the honest spiritualist is undeniable. He approaches the man of science not as an inquirer —he does not know what inquiry is— but he comes with his mind made up, saturated with credulity, and full of tales about what is going on in transcendental spheres, psychic realms, and the supernatural world. Witness the harmonical philosophy of A. J. Davis, based upon intercourse with invisible beings; witness Mr. Kiddle's late book filled with alleged communications from the spirit-world. The whole mass of modern spiritualistic literature is made up of revelations claiming to be supernatural, and to constitute a modern miraculous dispensation. The assumption which underlies all this contradicts the truth which is at the foundation of all science. The believers in astonishing revelations ask for "investigation": their claims have been investigated for five hundred years, and all science is a report against them.

The state of mind here betrayed is simply lamentable; in respect of intelligence, it is not one whit in advance of the veriest superstitions of the middle ages. Spiritualists are men to

whom science *teaches* nothing; they reap its material advantages, but repudiate all its higher lessons. Practically they hold to the unalterable uniformities of nature. They ply the arts of industry, telegraph around the world, trust their lives on the flying train, and in a thousand exposures, practically certain that there will never be a hair's breadth of failure in the adamantine order of natural laws; and then they formulate a belief in ghosts who can kick holes through the rotten contexture of nature anywhere! Such beliefs are pernicious, not only because they are intrinsically false and absurd, but because they are in vicious hostility to science, and are a fatal obstruction to the advance of rational education. That science, as the most perfect form of knowledge, and therefore the true basis of education, has never had even decent consideration in the New York schools, is sufficiently well known; nor is the explanation far to seek, when their head turns out to be a spiritualist, and opens his book of revelations by the virtual announcement that he is miraculously called of God to arrest the course of modern scientific thought! If it be said that this is only the private eccentricity of a single person, the reply is, that we have yet to learn that it is not representative of the power that controls education in this city. The President of the Board of Education is reported to have said, when interviewed with reference to the removal of the Superintendent, "The strong feeling against him in the minds of the Commissioners who are opposed to Mr. Kiddle, arises not so much from any desire to interfere with his private opinions about spiritualism, as practically to show their disapprobation of the vapid trash to which he lends his sanction as communications from the spirits of the departed." From which we are to infer that, if the aforesaid "communications from the spirits of the departed" had been a little less vapid or trashy in their form, the board of officers who have in charge the formation of the minds of the young in this metropolis would have no objection to them. Our objection is not merely or mainly to the worthless character of Mr. Kiddle's book, but that it is an official insult to science; and we say that the mind which could dally with such vagaries is not fit to guide and shape the education of the young. We do not suppose that the New York Board of Education is constituted of men who either know or care much about science, or sound principles of education; but, as a new question is forced upon them which they can not escape, we respectfully commend to their consideration the instructive article of Professor Wundt.

HARRIS ON SOCIAL SCIENCE.

Superintendent Harris, of St. Louis, has put forth an address on the "Method of Study in Social Science." The subject treated is important, and we took up his pamphlet hoping that, as an advanced educational leader, he had addressed himself to it with the practical view of determining the form and place it should take as a popular study in our American school system. We have long felt that it was desirable to have this done. Surely a State system of education, upon which millions are spent under the pretext that popular intelligence is necessary to the maintenance of free government, can not go on for ever ignoring all serious study of the natural laws of society, or the science of social relations. But we were disappointed. Mr. Harris gives us no help of the kind expected. On the contrary, his mode of dealing with the subject would seem to leave us no social science at all. He, however, speaks with an authority that is sure to give weight to his utterances, and it therefore becomes desirable to point out in what respect his views are misleading.

Mr. Harris begins his discourse with an excellent presentation of the method of the science of the present day. He recognizes that its tendency is to pass from the mere sensible properties of objects to their relations by saying: "No object can be understood by itself, and even the weather of to-day is found to be conditioned upon antecedent weather. . . . Science sees the acorn in the entire history of the life of the oak. It sees the oak in the entire history of all its species, in whatever climes they grow. . . . We must trace whatever we see through its antecedent forms, and learn its cycles of birth, growth, and decay. . . . We must learn to see each individual thing in the perspective of its history. . . . as a part of a process. . . . The ordinary habit of mind occupies itself with the objects of the senses, and does not seek their unity; . . . the scientific habit of mind chooses its object, and persistently follows its thread of existence through all its changes and relations."

All this is as true as it is well stated, and Mr. Harris, moreover, agrees that this method is coextensive with nature, and is therefore properly characterized as "natural science." But he knows a place where it does not apply and can not reach; a place so far set off from nature that it requires a new method of study, and gives rise to a new kind of science different from the common kind; and this, strange to say, is social science. He says: "Social science deals with man. Man has a natural being as a mere animal, as well as a spiritual being of intellect and will. . . . Man is not only an animal, having bodily wants of food, clothing, and shelter, but he is a spiritual being, existing in opposition to nature. . . . Man as a child or a savage is an incarnate contradiction; his real being is the opposite of his ideal being. His actual condition does not conform to his true nature. His true human nature is reason; his actual condition is irrational, for it is constrained from without, chained by brute necessity, and lashed by the scourges of appetite and passion. There is thus a paradoxical contrast between nature and human nature. . . . As man ascends out of nature in time and space into human nature, he ascends into a realm of his own creation. . . . The natural self must be abdicated in order that the personal self may be realized."

This theory of human nature is not new, but Mr. Harris certainly proposes to make a new use of it. For thousands of years it has been customary to divide man into two natures: a low, gross, corrupt, perishable, animal nature to be reprobated and renounced; and a high, pure, exalted, immortal nature, chained to the brutal part, and at war with it through all the course of our earthly life. This view has long been useful to theologians and moralists, but Mr. Harris is the first to reconstruct modern science on this basis. He would hand over the bestial, vulgar, and vilified part of humanity to "natural science"; and he would erect the upper and nobler portion into a new kind of science by a new method; and, as it is the more exalted portion of man which he "realizes in institutions," the new method becomes that of social science.

Yet, with reference to science, lower and higher are all one, and man is a unity. His higher nature is phenomenal, and in its constitution, mode of acting, as well as in its productions, it is not chaotic, but orderly, and is thus open to investigation like all the other parts of nature. That there is a profound difference between the corporeal and the psychical parts of man involves no such consequences as are here assumed. However deep may be the diversities among the objects of study in nature, the method of science in dealing with them is the same; because science, being the most valid knowing, depends upon the laws of knowing, and not upon the differences among the objects in-

vestigated. A hundred years ago it was objected that the legitimate methods of science can not be applied to the study of living things. Science had been created by investigations in the inorganic sphere, and true science was held to be limited to that sphere. When the inquirer left his gases, ores, and metals, to cross the boundary and begin a search into the nature of things that live, he was told that life is a mysterious realm where vitality suspends inorganic laws, and holds sway above nature and in opposition to it. Yet the province was long since conquered, and annexed to the domain of "natural science." The question in any case is simply this: Are we dealing with phenomena that may be observed, compared, analyzed, generalized, and reduced to a body of principles?

Mr. Harris discredits the method of natural science in its application to society, as follows: "From the fact that all merely natural beings—whether mineral, plant, or animal—never rise to the form of self-knowing and self-realizing, it follows that the application of scientific method to the explanation of human institutions in the ordinary form is not valid. In nature we explain the present by the past. If we attempt to explain the institutions of the family, society, and the state, by the rudimentary forms found in the childhood of the race, or, still worse, by the habits of the higher animals—as the ape tribe, for example—we shall invert the true method for social science. Since all of man's institutions arise as forms of combination, which he has made in order to realize an ideal, it follows that the first ones, historically, are so rudimentary as scarcely to indicate their object, while the later and latest ones contain the explanation of themselves and of their predecessors."

We gather from this that Mr. Harris's "Method of Study in Social Science" is to ignore the historical aspect of the subject, and begin with the study of the most complex institutions. Then why not adopt the same method in the study of other subjects? Fancy him addressing a mathematical teacher as follows: "Since the advanced rules of arithmetic arise as forms of combination, which the mathematician has made in order to realize an ideal, it follows that the first rules are so rudimentary as scarcely to indicate their object, while the later and latest contain the explanation of themselves and of their predecessors; therefore, begin your class and keep it occupied with problems in the last portions of the text-book." On the contrary, it is the law of method in all study to proceed from the simple to the complex, from the lower to the higher, and to explain the more developed by the less developed. Mr. Harris's "method" would put an end to all embryological study; for, if society is not to be studied historically because its first forms "are so rudimentary as scarcely to indicate their object," is not that equally true of *all* rudimentary forms? His method is false everywhere. Adult institutions, like adult animals, can only be explained by beginning with their germs and tracing the course of organization.

But Mr. Harris does not leave us to infer the character of his new social science; he gives the formula of its method in explicit terms, as follows: "For the study of society, then, one must seek his principle of explanation not in the child or the savage, but in the ideals of the prophets of humanity. We are to understand Greek life through a study of Homer and Plato; the middle ages through Dante and Thomas Aquinas; modern times through Shakespeare and Goethe."

So we are to omit the child and the savage in the study of society; and Mr. Harris adds, "Above all, we must not make the mistake of studying man as a simple individual." But what will then be left to study? We have always

supposed that society was made up of children, savages, and individuals, and that according to the natures and attributes of these units would be the character of the societies formed of them. But this it seems is a case in which the properties of a whole are not dependent upon the properties of its parts. Verily it would be an extraordinary "social science" that should arise by omitting the study of man as an individual, and interpreting society by the ideals of its literary prophets.

LITERARY NOTICES.

SPENCER'S SYNTHETIC PHILOSOPHY:

THE DATA OF ETHICS. By HERBERT SPENCER. New York: D. Appleton & Co. Pp. 288. Price, $1.50.

THIS little book is the first part of the treatise on morality that will close Spencer's "System of Philosophy." As explained in his preface, it is the result of long preparation, and is published not in the order he at first designed. He says: "I have been led thus to deviate from the order originally set down by the fear that persistence in conforming to it might result in leaving the final work of the series unexecuted. Hints repeated of late years with increasing frequency and distinctness have shown me that health may permanently fail even if life does not end before I reach the last part of the task I have marked out for myself. This last part of the task it is to which I regard all of the preceding parts as subsidiary. Written as far back as 1842, my first essay, consisting of letters on 'The Proper Sphere of Government,' vaguely indicated what I conceive to be certain general principles of right and wrong in political conduct; and, from that time onward, my ultimate purpose, lying behind all proximate purposes, has been that of finding for the principles of right and wrong in conduct at large a scientific basis. To leave this purpose unfulfilled, after making so extensive a preparation for fulfilling it, would be a failure, the probability of which I do not like to contemplate; and I am anxious to preclude it, if not wholly, still partially. Hence the step I now take. Though this first division of the work, terminating the 'Synthetic Philosophy,' can not of course contain the specific conclusions to be set forth in the entire work, yet it implies them in such wise that definitely to formulate them requires nothing beyond logical deduction."

But few will deny the importance of the work which Mr. Spencer has so long had in view for, of all fields of thought, the ethical is in the most chaotic condition. Some find the grounds of morality in the Ten Commandments, and others in the rules of the New Testament. The fear of hell is appealed to as a motive to right conduct, and the divine intuitions of conscience are claimed as guides to duty. As faith in the supernatural declines, many are left without any authoritative moral guidance, while some fall back on a prudential utility, and others upon the interdicts of public law. These theoretical discords are accompanied by varying standards of right and wrong in different states and periods of society, while everywhere are seen the most glaring discrepancies between professed moral precepts and actual moral practice.

Meantime, in other fields of thought, science is the great reconciler of conflicting opinions. By the establishment of comprehensive principles that command universal assent, it is constantly bringing men into better agreement; and it has thus become an authority that is enforcing the submission of the human mind with steadily increasing power. Moral phenomena, like mental and physical phenomena, are obedient to principles of order, and are thus amenable to scientific method; science, therefore, must traverse the ethical field in its legitimate progress; and there is no reason to doubt that it will perform the same benign office of illumination and guidance here, that it has performed in the other great spheres of its application.

But, if this is true, it may well be asked why science has not long since accomplished so desirable a work. It is because centuries of preparation were required to develop the preliminary sciences and perfect the method of inquiry; and because it is a task of such difficulty that but few men could be expected to combine the scientific qualifications, the patient, untiring industry,

and the sustained interest in the subject necessary to deal with it adequately and successfully. Mr. Spencer entered upon this line of study in his youth, and has devoted his life to it. He has explored and reorganized several of the great divisions of science with reference to their ultimate bearings upon the problem of scientific morality; and he is undoubtedly the first to work out the philosophical relations of the sciences to a new system of ethical doctrine.

In this brief notice of a work that requires to be thoughtfully read, we can no more than open the subject; and this can best be done by anticipating certain questions that will arise at the outset in the minds of many readers. It will be said, in the first place: "We know something about morality, having often heard it expounded and applied. It lays down the regulations of behavior. Government enforces it by its laws, and society rests upon it. It seems a very practical, common-sense thing that everybody can understand, as we must all obey its injunctions; but what on earth do you mean by 'scientific morality'?"

The reply is, that "scientific morality" is that kind of morality which can give valid reasons for its requirements. Science stands in just the same relations to morality that it does to every other kind of human activity—it explains it. Dyeing was long a successful practical art; but it consisted in following a set of blind rules, and its operations were imperfect. Science explained it, and gave principles instead of rules, which gave the reason of many failures, and led to greatly improved practice. In like manner morality follows blind and arbitrary rules, and its practice is notoriously imperfect. Science will substitute intelligible principles for these rules which will account for numerous failures, and lead to better practice.

The question may be answered in another way. It is the object of Mr. Spencer's present work to lay the foundations of an ethical system that shall have the validity and authority of scientific truth, by showing that the principles of right and wrong in human conduct are grounded in the constitution of nature. It is obvious that, until the order and course of nature were understood, such an inquiry must have been unsuccessful and impossible. Science alone explains that order, and therefore furnishes the facts and truths that are necessary to the investigation. But if science, by this elucidation, has supplied the data from which the principles of morality can be derived, and its practice consequently perfected, the working out of the subject must give us a "scientific morality."

In the next place it will be asked: "What has morality to do with evolution? As the best ethical maxims go back to a high antiquity, and as, according to Mr. Buckle, while the intellect is progressive, morals are stationary, what possible relation can the evolution theory have to ethics?" Mr. Spencer furnishes the answer to this question at the very opening of his book, and in a way which shows that, if evolution be true at all, it has everything to do with morality.

His first chapter is on "Conduct in general," and he begins by illustrating the truth that no correct idea can be formed of a part without a knowledge of the whole to which it belongs. A detached arm could not be understood by a being ignorant of the human body; the moon's movements can not be interpreted, except in connection with the movements of the solar system; a fragment of a sentence is unintelligible if separated from the remainder.

Morality deals with a certain kind of human conduct, but this implies that there is another kind, of which moral conduct is but a part. Again, the term "human conduct" implies that there is a conduct manifested by creatures other than human, so that human conduct becomes a part of a still larger whole. Conduct is defined as actions adjusted to ends, and is displayed in ever-varying degrees of simplicity and complication throughout the entire scale of animate being. Animals low in type, in seeking food, adjust actions to ends, and, as we rise through the series, such adjusted actions become more varied, combined, and perfect, until man is reached, when the adjustments become far more complex and involved, and the ends attained more numerous, varied, and remote. Mr. Spencer says: "Complete comprehension of conduct is not to be obtained by contemplating the conduct of human beings only: we have to regard this as a part of universal conduct—conduct as exhibited by all living creatures. Just as, fully to understand the part of con-

duct which ethics deals with, we must study human conduct as a whole, so, fully to understand human conduct as a whole, we must study it as a part of that larger whole constituted by the conduct of animate beings in general. Nor is even this whole conceived with the needful fullness so long as we think only of the conduct at present displayed around us. We have to regard the conduct now shown us by creatures of all orders as an outcome of the conduct which has brought life of every kind to its present height, and this is tantamount to saying that our preparatory step must be to study the evolution of conduct."

The second chapter is devoted to "The Evolution of Conduct," and its import may be gathered from the concluding passage: "Guided by the truth that as the conduct with which ethics deals is part of conduct at large, conduct at large must be generally understood before this part can be specially understood; and guided by the further truth that to understand conduct at large we must understand the evolution of conduct, we have been led to see that ethics has for its subject-matter that form which universal conduct assumes during the last stages of its evolution. We have also concluded that these last stages in the evolution of conduct are those displayed by the highest type of being, when he is forced by increase of numbers to live more and more in presence of his fellows. And there has followed the corollary that conduct gains ethical sanction in proportion as the activities becoming less and less militant and more and more industrial are such as do not necessitate mutual injury or hindrance, but consist with and are furthered by coöperation and mutual aid."

The position here assumed at the outset that morality is a product of evolution is illustrated and confirmed with convincing force throughout the work. Why the moral restraints of conduct are the latest evolved appears by considering the nature of the different kinds of control to which men have been subjected during the unfolding of society. As fully explained in the "Sociology," society begins only in subordination to violent external restraints. The rule of the despotic chief is the germ which develops into the political control of human conduct. The primitive fear of the ghost of the dead chief develops into the superstitious dread of unseen forms, and ultimately becomes that powerful religious control which is so potent in influencing the actions of men. A later developed but definite and powerful form of restraint upon conduct is the influence of public opinion, or the force of social reprobation. The results of these forms of external coercion are so simple, direct, and easily conceived that they are well fitted to act upon undeveloped natures, and they come into play first in the order of social progress.

The moral motive to conduct differs from the preceding by recognizing the results that actions naturally produce. As Mr. Spencer remarks: "We are now prepared to see that the restraints properly distinguished as moral are unlike these restraints out of which they evolve, and with which they are long confounded, in this—they refer not to the extrinsic effects of actions but to their intrinsic effects. The truly moral deterrent from murder is not constituted by a representation of hanging as a consequence, or by a representation of tortures in hell as a consequence, or by a representation of the horror and hatred excited in fellow men; but by a representation of the necessary natural results—the infliction of death-agony on the victim, the destruction of all his possibilities of happiness, the entailed sufferings to his belongings. Neither the thought of imprisonment, nor of divine anger, nor of social disgrace, is that which constitutes the moral check on theft; but the thought of injury to the person robbed, joined with a vague consciousness of the general evils caused by disregard of proprietary rights.

"And now we see why the moral feelings and correlative restraints have arisen later than the feelings and restraints that originate from political, religious, and social authorities; and have so slowly, and even yet so incompletely, disentangled themselves. For only by these lower feelings and restraints could be maintained the conditions under which the higher feelings and restraints evolve. It is thus alike with the self-regarding feelings and with the other-regarding feelings. The pains which improvidence will bring, and the pleasures to be gained by storing up things for future use and by laboring to get such things, can be habitually contrasted in thought, only

as fast as settled social arrangements make accumulation possible; and, that there may arise such settled arrangements, fear of the seen ruler, of the unseen ruler, and of public opinion, must come into play. Only after political, religious, and social restraints have produced a stable community, can there be sufficient experience of the pains, positive and negative, sensational and emotional, which crimes of aggression cause, as to generate that moral aversion to them constituted by consciousness of their intrinsically evil results. And more manifest still is it that such a moral sentiment as that of abstract equity, which is offended not only by material injuries done to men, but also by political arrangements that place them at a disadvantage, can evolve only after the social stage reached gives familiar experience both of the pains flowing directly from injustices and also of those flowing indirectly from the class-privileges which make injustices easy."

We are here brought to another exemplification of the method of scientific morality, as influenced by the doctrine of evolution. If the higher control of conduct is derived from a knowledge of its consequences, then the supreme problem of morals is the study of causation in human actions. Everything here turns on the relation of cause and effect; and Mr. Spencer shows conclusively that the development of the idea of causation is one of the latest results of man's intellectual progress. The conception of causation as necessary and universal has even yet been reached only by a small circle of strict scientific thinkers. This is the radical defect of the earlier and current moral systems. In his chapter on "The Ways of judging Conduct," Mr. Spencer proves that the religious, the intuitional, the political, and the utilitarian schools are here alike deficient: "They do not erect into a method the ascertaining of necessary relations between causes and effects, and deducing rules of conduct from formulated statements of them." Evolution, on the other hand, implying the persistence of forces and the continuity of effects, when applied to ethics must give us a new method of "scientific morality."

We have here touched only upon incidental points in Spencer's work; the fundamental principle of his system could have no justice done to it in such a notice. This idea is that pleasure and pain, in some form immediate or remote, are at the bottom of all good and bad, all right and wrong. The doctrine is involved in the statement that "there exists a primordial connection between pleasure-giving acts and continuance or increase of life, and, by implication, between pain-giving acts and decrease or loss of life"; or that it is "no more possible to frame ethical conceptions from which the consciousness of pleasure, of some kind, at some time, to some being, is absent, than it is possible to frame the conception of an object from which the consciousness of space is absent. And now we see that this necessity of thought originates in the very nature of sentient existence. Sentient existence can evolve only on condition that pleasure-giving acts are life-sustaining acts."

We think that the verdict on this book of all candid readers will be that it accomplishes what it professes to accomplish—it finds for the principles of right and wrong in conduct a scientific basis; and, if this be true, it is needless to say that its effect will be to give a new impulse and a new direction to ethical studies.

THE SPORTSMAN'S GAZETTEER AND GENERAL GUIDE. The Game Animals, Birds, and Fishes of North America; their Habits and Various Methods of Capture. Copious Instructions in Shooting, Fishing, Taxidermy, Woodcraft, etc. Together with a Glossary, and a Directory to the Principal Game Resorts of the Country. Illustrated with Maps. By CHARLES HALLOCK, Editor of "Forest and Stream," etc. Fifth edition. New York: Forest and Stream Publishing Co. 1879. Pp. 920. Price, $3.

THE scope and purpose of this volume are so fully set forth in the title that there is no need of further particularizing its contents. The "Gazetteer" is an indispensable part of the outfit of hunters and fishers throughout the United States and the Canadas. In this fifth edition nothing appears to have been omitted which should properly have a place in such a manual. The Glossary is one of the new features introduced in this edition, and it adds greatly to the value of the work. Here are to be found definitions of common words in local use throughout North America. Strangers are

often sorely puzzled by these localisms, and Mr. Hallock does well in providing them with an interpreter.

THE JOURNAL OF PHYSIOLOGY. Edited by Dr. MICHAEL FOSTER. Vol. I., Nos. I. to VI., 496 pages; Vol. II., No. I., 90 pages. New York: Macmillan & Co.

THE first volume of this most valuable periodical is now completed, and the first part of the second volume is also published. We again call the attention of our scientific and medical readers to its merits, and also urge for it the patronage of liberal-minded men whether professional or not. To those interested in its discussions we need not say that it is invaluable, as it represents the progress of research in physiological science, and gives the latest trustworthy results on a wide range of subjects. It is edited by an able corps of gentlemen, who, of course, contribute their services freely, and with no thought of remuneration, from simple love of the promotion of knowledge. And who is not interested in the advancement of this branch of science. "The Journal of Physiology" ought to be taken in every library, college, and high-school, if for no other reason than because it is a public duty to sustain it. It is a scandal to civilization that, when wealth is squandered so profusely on absolutely worthless things, men of science, living on stipends, and giving their very life-blood to laborious researches, should have to retrench their vital necessities to pay for the publication of their original work, which is of untold value to the community.

People generally have but a very imperfect idea of the activity of scientific inquiry at the present time, because it is a world by itself, with which our literary, political, and religious classes have very little concern or sympathy. The physiological division of science furnishes a very good illustration of the extent of this vigorous original work. The editors of "The Journal of Physiology" have issued a supplement to Vol. I. containing a list of titles of works and papers of physiological interest published in 1878. We subjoin the classified headings of this list, which will convey an idea of the scope of these investigations, and give the number of works that appeared last year in each division:

	Works.
1. Text-books, Methods, etc.	41
2. General Physiology, General Properties of Protoplasm and Cells.	29
3. General Chemistry of Tissues and of Animal and Vegetable Substances	85
4. General Physics	22
5. Structure and Properties of Cartilage, Bone, and Connective Tissues	19
6. Blood, Structure and General Features.	20
7. Circulation	100
8. Lymphatic System	6
9. Alimentary Canal, Digestion, etc.	56
10. Respiration	31
11. Perspiration, etc.	20
12. Urine	44
13. General Metabolism of Body	44
14. Animal Heat	8
15. Structure of Contractile and Nervous Tissues	28
16. General Properties of Contractile Tissues, Muscle, and Nerve	41
17. General Nervous System	99
18. Eye, Vision	86
19. Ear, Hearing	16
20. Skin, Touch	14
21. Speech	13
22. Locomotion	3
23. Reproduction	29
24. Action of Drugs	83
25. Ferments, etc.	64
Total	1,010

SOUVENIRS OF MADAME VIGÉE LE BRUN. With a Steel Portrait from an Original Painting by the Author. New York: R. Worthington. Pp. 398. Price, $1.75.

MADAME LE BRUN was born in Paris in 1755, and died in 1842, and during the greater part of that time was employed in painting the portraits of the reigning families of Europe. She was the contemporary and friend of Joseph Vernet, of Benjamin West, and of Sir Joshua Reynolds, all of whom bore testimony to her rare ability as an artist. It is said that, on the opening in London of her portrait of Calonne, a bystander remarked: "It ought to be good, for Madame Le Brun received £3,200 for it"; when Sir Joshua replied, "If they gave me £4,000 for it, I could not have done it as well." Being not only a great favorite at the different European courts, but her *salon* forming a rallying-point for the most distinguished people in fashion, in literature, and in art, she had at her command a surprising wealth of material, and these reminiscences form a curious though unconscious history of the morals as well as the manners of that interesting period.

Take for instance her *naïve* accounts of her intercourse with the Duchess du Barry, Catharine II., and Lady Hamilton. The most interesting of her souvenirs are those connected with the reigns of Louis XVI. of France, of Catharine II. and Paul I. of Russia, of Queen Caroline of Naples, and of George III. of England, and the most distinguished of their subjects in every department. D'Alembert, La Harpe, Abbé Sieyès, Talleyrand, Prince Kaunitz, Poniatowski, Potemkin, Angelica Kauffmann, Catalini, Mademoiselle Mars, Madame Récamier, the Duchess of Devonshire, Herschel, Sir Francis Burdett, etc., furnish abundant subject-matter for her lively and gossiping details.

OUTLINES OF FIELD GEOLOGY. By ARCHIBALD GEIKIE, F. R. S., Director of the Geological Survey of Scotland. New York: Macmillan & Co. Pp. 222. Price, $1.

PROFESSOR GEIKIE'S lectures upon this subject, delivered at the South Kensington Museum in 1876, and subsequently printed in a pamphlet form, were noticed at the time of their appearance. He dwelt upon the methods of observation requisite in ordinary field geology, with practical directions for noting and recording the facts observed. It met with a cordial reception, and a large impression was disposed of. The author has now rewritten and enlarged the work, dropping the lecture form, increasing the illustrations, and giving it a shape that will make it a standard guide for geological students. The book assumes that the young geologist has read some good text-book and got a general knowledge of the elementary principles of the subject, and then wishes to become acquainted with the science as a reality. It is for the use of those who, having a book-knowledge of geology, "find themselves helpless when they try to interpret the facts which they meet with in the field. The practical knowledge of which they feel the want is not to be gained from books. It must be sought in quarries and ravines, by hillside and seashore. But hints regarding what should be looked for and how to set about the search may not be without some usefulness; and these it is the object of the following pages to give."

MANUALS FOR TEACHERS. No. 1. THE CULTIVATION OF THE SENSES. Philadelphia: Eldridge & Brother. Pp. 96. Price, 50 cents.

IT is announced that this series will contain four more works—"The Cultivation of the Memory," "On the Use of Words," "On Discipline," and "On Class-Teaching." The publishers say: "These manuals were originally published in England, having been prepared, at the request of the Literature Committee of the National Educational Society, by men distinguished at their several universities, and possessed of large experience as teachers. They have been carefully revised and adapted to the wants of American teachers, and it is hoped will prove a valuable addition to the literature of the art and science of teaching." We suspect that these distinguished university men are myths; at any rate the present volume betrays no such distinguished origin. It is a very good little compilation from various authorities; but how comes it that, while Spencer, Taine, and Darwin are quoted, no mention is anywhere made of Miss Youmans's essay "On the Cultivation of the Observing Powers of Children," which is freely copied, and whole pages taken bodily without any recognition? The publishers bring out the series in a very neat and substantial form.

ELEVENTH ANNUAL REPORT OF THE TRUSTEES OF THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY. Vol. II., No. 2. Cambridge: The Trustees. 1878. Pp. 286.

DURING the past year the Trustees of the Peabody Museum took possession of the new building specially erected at Cambridge for the purpose of holding their ethnological and archæological collections. The report contains, besides a description of this building, a history of the Peabody Museum, by the Hon. Robert C. Winthrop, the report of the Curator, and a number of contributions on archæological subjects, viz.: Dr. Abbott's second report on implements found in the glacial drift of New Jersey; remarks on the method of manufacture of several articles by the former Indians of southern California, by P. Schumacher; on cave-dwellings in Utah, by E. Palmer; on the manufacture of soapstone pots by the Indians of New England, by F. W. Putnam; on a collection

from an ancient cemetery in southern Peru, by J. H. Blake; on archæological explorations in Tennessee, by F. W. Putnam; on crania from the stone graves of Tennessee, by L. Carr; and on the tenure of land among the ancient Mexicans, by Ad. F. Bandelier.

FIRST ANNUAL REPORT OF THE UNITED STATES ENTOMOLOGICAL COMMISSION. Washington: Government Printing-Office. 1878. Pp. 500, with Maps and Plates.

WE have here in full detail the first year's labors of the United States Entomological Commission, appointed by Congress to study the best methods of preventing the ravages of the Rocky Mountain locust. The habits of the insect, its geographical distribution, and many other points in its natural history, have been pretty satisfactorily determined by the Commission; and, if the Commission has not succeeded in discovering *the* method of getting rid of the pest, it has at least indicated many ways of lessening its violence, and of partially staying its advance.

SEVENTH REPORT OF THE STATE ENTOMOLOGIST ON THE NOXIOUS AND BENEFICIAL INSECTS OF THE STATE OF ILLINOIS. By C. THOMAS, Ph. D., State Entomologist. Springfield, Illinois: D. W. Lusk print. Pp. 290.

THE most elaborate paper in this report is one entitled "Notes on Corn Insects, or Insects injurious to Indian Corn." The author has been investigating this special subject for a long time, and his results, as here stated, are eminently worthy of the attention of the farmer. These "Notes" occupy the first one hundred pages of the report; the remainder is devoted to miscellaneous notes and observations on different species of noxious and beneficial insects.

PROGRESSIVE JAPAN: A STUDY OF THE POLITICAL AND SOCIAL NEEDS OF THE EMPIRE. By General LE GENDRE. San Francisco: A. L. Bancroft & Co. 1878. Pp. 380.

IN this study of the social and political needs of Japan, General Le Gendre has sought mainly from the history of the Japanese people the aid which others might perhaps have preferred to ask solely from abstract Western sciences. "It is," he writes, "by interpreting a people's traditions, by carefully listening to the mysterious teachings of the wise men who, in remote ages, guided its infancy, that one is apt to discover the early promise of its future." Therefore, in the reconstruction of the political state of Japan, care must be taken not to do violence to the national genius by prematurely introducing Western institutions. The author treats at great length of "Reconstruction," and points out the direction which, in his opinion, it must take in order to produce the largest measure of good for the Japanese people.

PUBLICATIONS RECEIVED.

The Historical Poetry of the Ancient Hebrews, translated and critically examined. By Michael Heilprin. Vol. I. New York: D. Appleton & Co. 1879. Pp. 343. $2.

Report of the Chief Signal Officer to the Secretary of War, 1878. Washington: Government Printing-Office. Pp. 680, with Plates and Charts.

The Silk Goods of America. By William C. Wyckoff. New York: D. Van Nostrand. Pp. 120.

Laboratory-Teaching, or Progressive Exercises in Practical Chemistry. By C. L. Bloxam. Philadelphia: Lindsay & Blakiston. 1879. Pp. 261. $1.75.

An Introduction to Commercial Organic Analysis. By A. H. Allen, F. C. S. Vol. I. Same publishers. Pp. 374. $3.50.

Geological Survey of Indiana, 1878. By E. T. Cox, State Geologist. Indianapolis: "Journal" print. Pp. 541, with Maps.

Report of the Chief Engineer of the Philadelphia Water Department, 1878. Philadelphia: Markley & Son print. 1879. Pp. 111.

Tovey's Brewers' Directory for 1879. New York: A. E. Tovey, 24 Park Place. Pp. 115.

Sketch of Dickinson College. By C. F. Hines, Ph. D. Illustrated. Harrisburg: L. S. Hart. 1879. Pp. 155.

Around the World with General Grant. By J. R. Young. Published in 20 Parts, at 50 cents each. Illustrated. New York: American News Company.

Chemistry, Theoretical, Practical, and Analytical. Parts 36 to 40. 50 cents each. Philadelphia: J. B. Lippincott & Co.

Twelfth Annual Meeting of the Free Religious Association, 1879. Boston: The Association. Pp. 80.

Dictionary of Music and Musicians. Part 7. New York: Macmillan & Co. $1.25.

Brentano's Aquatic Monthly and Sporting Gazetteer. New York: Brentano. Monthly. $4 per year.

Future Development of the New York State Library. Albany: Van Benthuysen & Sons. Pp. 48.

Lake Chautauqua Illustrated. Buffalo: Peter Paul & Bro. Pp. 60.

The Chaco Cranium. By W. J. Hoffman, M. D. Washington: Government Printing-Office. Pp. 25, with Plates.

Explorations and Surveys in the Department of the Missouri. By E. H. Ruffner, Engineer

Corps U. S. A. Washington: Government Printing-Office. 1878. Pp. 115.

On a New Base. By E. F. Smith. From "American Chemical Journal." Pp. 8.

The Tornado of April 14, 1879. By J. L. R. Wadsworth, M. D., and F. E. Nipher. From "Transactions St. Louis Academy of Science."

Thevetia Iccotli and its Glucoside. By D. Cerna, M. D. From "Philadelphia Medical Times." Pp. 6.

Annual Announcement of the Stevens Institute of Technology. Pp. 104.

Report of the Work of the Agricultural Experiment Station at Middletown, Conn. Hartford: Case, Lockwood & Brainard Company print. Pp. 174.

On a Foundation for a Religion. Boston: G. H. Ellis print. Pp. 48.

Geological Formations crossed by the Syracuse and Chenango Valley Railroad. By L. M. Underwood. Syracuse: "Standard" print. Pp. 18.

Wandering Cainidæ, or the Ancient Nomads. By M. Kempe, M. D. Louisville, Ky.: Morton & Co. print. Pp. 41. 25 cents.

POPULAR MISCELLANY.

American and European Archæology.—A marked difference is observable between Europe and America with respect to the order of succession of the different prehistoric human "periods" to one another. In fact the succession is in the one exactly the reverse of what it is in the other. This difference is clearly expressed by the Rev. Stephen D. Peet in an article on "The Archæology of Europe and America." "In Europe," he says, "the cave-hunter, who used bone implements, first departed; the fisherman of the kitchen-midden next passed away; the builder of the earth-mounds followed with his rude weapons, and the inhabitants of the palafitte next disappeared; and last of all the Etruscan, the builder of the rude stone monuments. Thus Esquimau, Basque Briton, Belgian, Celt, Saxon and Etruscan [?], are the successors to one another, while on this continent Quiches, Toltec, Aztec, Mound-builders, Red Indians, and Esquimaux are the silent throng who have reversed the column of departure. The Esquimau was ruder than the Basque, and the Basque than the Briton, and so the order of departure gave place to a higher culture. In America the most civilized was the soonest removed, and the rudest remained the longest. The ancient city was deserted, but the pueblo remained; the pueblo itself changed inhabitants, but the Mound-builder remained; the Mound-builder was driven away, but the Red Indian continued; the Red Indian has disappeared, but the Esquimau abides. The palaces of Palenque and Uxmal and the seven cities of Cibola are monuments of a civilization more ancient than the Mound-builders. The mounds of the Mississippi Valley were doubtless erected by a more ancient race than the people who occupied at the time of their discovery. The Red Indians held an unbounded dominion more ancient than the villages which they inhabited, and the Esquimaux may possibly have once covered the whole land where all of these tribes so lately roamed, but the last survivor of all is now the rudest and wildest."

Division and Distribution of the Electric Light.—A method of *dividing electric light* (not the electric current, but the light itself) has been devised by two engineers of San Francisco, E. J. Molera and J. C. Cebrian. The scheme looks plausible, but the public can afford to wait till it has been put to a practical test. We give the inventors' own description of the *modus operandi* of their system: "We take," they say, "the most powerful source of light attainable, and place it in a closed chamber (*the chamber of light*). Every wall of this box is a condensing lens, which will shape the light into a beam of parallel rays. In this way we reduce our source of light to several beams of parallel rays. If we intercept one of these beams of parallel rays of light by a reflector, the light will be bent or reflected according to the position of the reflector; and it may thus be sent into any desired direction, horizontal, vertical, or any way inclined. When the reflector intersects the whole beam of light, this latter one will be bent totally; if only one fraction of the sectional area of said beam is intersected, then the corresponding fractional part of the beam will be bent, leaving the other fraction thereof to follow its former direction. Therefore, if one of said beams of light is intersected at different points of its length, by different reflectors, intersecting different fractional parts of its section, said beam will be divided into a great number of secondary beams, going in any desired direction, and if these secondary beams are treated in the same way, the main beam can be di-

vided, subdivided, conveyed, and distributed to any number of distant places. If we inclose the main beam in a tube or pipe, and every secondary beam in smaller tubes, branching out from the larger one adjoining it, and we keep the above said reflectors at the elbows and intersections, or T-pieces, formed by all these tubes, we obtain a net or system of pipes or tubes similar to those used in the distribution of gas and water.

"Such is our system: in front of every side or face of our *chamber of light*, we place a box or pipe inclosing the main beams of light; these pipes are laid along the streets; at every side street a smaller pipe will branch out from the main one; at their junction we will place a reflector which will divert into the side street the desired percentage of light. And thus we can provide every street of a city with one or more pipes carrying a known amount of light. Then, from said street-pipes, service-pipes will be run into every lamp-post and every building, and at the intersection of the latter pipes with the street main we will insert proper reflectors, the size of which will determine the amount of light supplied by every service-pipe. In the same way that at present the gas-burners of all the rooms in a house are in direct successive communication with the gas-meter or service-pipe, for said house, through a net of pipes laid along ceilings and walls; similarly in our system, a net of properly branched-out pipes will put in communication every room of a building with the above-mentioned service-pipe; only that we will place at every junction, occurring in said net of pipes, a proper reflector, which will determine the amount of light carried by the corresponding pipe. Thus, the light may come into the rooms through the ceiling or through the walls, every room having as many outlets of light as desired. But the light will enter in a beam of parallel rays; therefore, in order to properly shape it for use, we will place at every outlet of light a *diffusing lens*, called a *secondary lens*, which will send the light around in any predetermined shape; thus completing the system of division and distribution of light from a single station to any or all the rooms in a city, and with any desired intensity."

Primitive Innocence.—In a letter read at a meeting of the Academy of Natural Science, of Philadelphia, Dr. Charles A. Siegfried, U. S. N., writes as follows: "We visited an island called Botel Tobago while surveying a rock, eighty miles east of South Cape, off Formosa. We found a race of aborigines, probably from Malay stock. They knew nothing of money, rum, or tobacco. They gave us goats and pigs for tin pots and brass buttons, and would hang around us all day in their canoes, waiting for a chance to dive for something thrown overboard. They wore clouts only; ate taro and yams mainly, though they have pigs, goats, chickens, and fish, and cocoanuts also. Snakes abound, of the boa variety, I judge. Their thatch houses are low, with much overhang of the roof, surrounded by stone walls, strongly made of laid stone, to protect them from monsoons. Their paddy-fields contain immense quantities of taro—*Colocasia aroidea*, my botany says. They are peaceful and timid, do not mark the body or deform the face or teeth, and seem happy enough in their condition. I found them fairly healthy. They had axes, spears, and knives, but all of common iron, the axe being made by imbedding the handle, instead of the handle piercing the iron, as with us. Their canoes are beautiful, made without nails, and are ornamented usually with geometrical lines. The hair is worn naturally, the men partly clipping theirs. I saw no valuable metal. They wore the beards of goats, with small shells, as neck ornaments."

New and Interesting Fossils.—While examining the "Atlantosaurus beds" of the Rocky Mountains, Professor Marsh discovered several interesting fossils, among them the lower jaw of a small mammal—a diminutive marsupial. This is the second mammal known from the Jurassic in this country. The specimen, which is from the left side, has the larger part of the ramus preserved, with a number of perfect teeth in position. Most of the symphysial portion is lost, and the posterior part is missing, or only faintly indicated. The jaw was remarkably long and slender. The horizontal portion is of nearly equal depth throughout, and the lower margin nearly

straight. The remarkable feature in this jaw is the series of premolar and molar teeth. These were very numerous, apparently as many as twelve in all, possibly more. In comparing this fossil with the forms already known, it is seen to differ widely from any living type. Its nearest affinities are with the genus *Stylodon* of Owen, and in many respects the correspondence is close.

In the "American Journal of Science," for September, Professor Marsh describes two lower jaws belonging to animals apparently of the same genus (*Dryolestes*) as the first American Jurassic mammal; these remains came from the same locality and horizon as the preceding. These new specimens furnish important characters to distinguish the genus. In one of them the angle of the lower jaw is strongly inflected, thus indicating its marsupial nature. The other proves that the genus is quite distinct from *Didelphys*, as there were at least four premolars. This specimen differs from the jaws of *Dryolestes priscus* (the first Jurassic mammal found in this country) in being more slender, less curved, and less compressed. Professor Marsh gave to the species the name *Dryolestes vorax*. The animal appears to have been smaller than *D. priscus*.

Classification of Words by Ideas.—At the recent Philological Convention at Newport, Mr. Stephen Pearl Andrews read an interesting paper proposing some further development of views previously suggested regarding the classification of terms by the ideas they represent, and he showed that the process already begun is capable of being carried to a far greater degree of simplification than has yet been reached. Mr. Andrews's paper was to the effect that there are two possible ways of pursuing the study of words, one of which only has heretofore been brought into use, and the adoption of the other one of which will constitute a new method and a new era in philology. These two ways are—1. To study the word, as a bundle of sounds, the body of the word first, and in the main, and the idea or meaning of the word in a secondary and incidental manner merely; and, 2. To study the idea embodied in the word, as the main thing, making the phonetic structure of the word secondary and accessory to the word. The first of these methods Mr. Andrews calls historical or physical, and the second ideological or psychical. The historical method is the current and triumphant method, initiated by Jacob Grimm, and now completed, in a sense, by August Fick, in the supplement to his dictionary of the Indo-Germanic language, where he sums up the root-words as a mere handful (50 to 500), from which all the words (virtually) ever spoken in southern and western Asia, and in Europe, are derived. This historical method Mr. Andrews also calls, therefore, the German method, and he thinks it has now achieved nearly all that it is able to do.

The ideological method has hardly yet been begun, and remains now to be elaborated. It was, however, unconsciously initiated by Noah Webster, in the introduction to his dictionary, while he was working for a quite different purpose, and may therefore be called, for easy distinction, the American method. As Fick reduces all the words we use to a mere handful, so Webster, on the other hand, reduces the *meanings* of all these words to a group of thirty-four leading ideas, a less number than that of Fick's root-words. Both the German and the American method are, therefore, traveling on the road to lingual unification, or, what is the same thing, to the reduction of language to an ultimate simplification. On the side of ideas this is the same as what the metaphysicians have sought to do, working abstractly, with their categories.

At this point, Mr. Andrews himself takes up the subject, on the side of ideas, or the American method, and pushes the simplification down to its utmost. He analyzes and further generalizes Webster's thirty-four classes of ideas, reducing them all to three grand major classes: 1. The idea of *division* or *apartness* (of, off, fromness); 2. The idea of *unity* or *togetherness* (at, to, with); and 3. The idea of vacillation between those two. These three ideas Mr. Andrews identifies with the *differentiation* and *integration* of Herbert Spencer, and with the coaction or interrelationship between those two ideas.

Mr. Andrews therefore entitles his method "The Ideological Method in Philology." His paper, which was long and elaborate, was listened to with the closest attention by the association throughout.

An Ironless Civilization.—Mr. A. Woeikof, in a narrative of his travels in Yucatan and the southeastern States of Mexico, published in "Petermann's Mittheilungen," introduces us to a so-called "civilized" people, who are practically unacquainted with the uses of iron. Writing about the northern portion of the State of Chiapas, he says that the inhabitants employ iron only in the shape of axes and machetes, which are imported from the United States. For the distance of one hundred kilometres round about Palenque not one blacksmith is to be found. Not a single nail is to be seen in their houses; everything is held together with cords or with vines. Even in the preparation of their usual article of food—tortillas—the apparatus they employ is equally primitive, though in this respect they follow the custom which is universal throughout all Mexico and Central America. The grains of maize are crushed between two stones, one of which, the nether one, is rather large, with a sloping upper surface. A woman kneels by this stone and strews upon it some grains of maize, over which she works to and fro another stone of cylindrical form, so grinding the maize. The coarse meal so obtained is baked into flat tortilla-cakes in the ashes. This is exactly the mode of preparing meal in vogue in Central and South Africa; the African negroes, however, show a higher grade of culture, inasmuch as they understand the working of iron. Our author caustically remarks hereupon that "the introduction even of hand-mills would be, for this country, a step of progress of far more value than many a high-sounding political prerogative, which can never be of any advantage to a population living in so low a grade of civilization."

A Two-Headed Snake.—H. Semler gives, in "Die Natur," an account of a living two-headed snake, found on the line of railroad from San José to Santa Cruz, and now on exhibition in the museum of the Woodward Garden in San Francisco. It is a gopher-snake (*Pelicophis Wilkesi*), a species which lives on gophers, rats, mice, and small birds. The gopher-snake is a perfectly harmless reptile, like all the other snakes of California except the rattlesnake. The two-headed snake is twenty-two inches in length; its age can not be determined, but is not over two or three months; the full-grown snake is seven to eight feet in length. Its color is a dirty yellowish-white, with a double row of chestnut-brown spots along the back; these spots are nearly square and seventy-five in number. On each side is a row of smaller spots of the same color and shape. On both of the necks up to the heads are also several small spots. From the point where the necks fork to the extremities of the jaws is one inch and a half. The heads and necks are perfectly separate and about one inch apart; each head and each neck is fully formed and in every respect symmetrical. Each of the heads has two large eyes. The animal can put out each of the two forked tongues separately or together. The two jaws open into one throat. As each neck is perfectly flexible, the snake can turn each of its heads in any direction at pleasure. It oftentimes lays its two heads close together; often it spreads them as far apart as possible, or rests one upon the other. It takes its food through either mouth indifferently, and both jaws seem to possess the same power. Some years ago a Missouri farmer, in plowing, found a rattlesnake which in like manner had two fully-formed heads, and a merchant of San Francisco avers that he observed a similar *lusus naturæ* in a Java snake.

The Color-Sense in Savages.—In order to determine the capacity possessed by uncultivated races for distinguishing different colors and shades of color, Mr. Albert S. Gatschet prepared a series of colored paper slips, twenty in number, insensibly blending into each other, and by personal inquiry ascertained the names employed by various tribes of American Indians for designating these differences. The result, published in the "American Naturalist," does not throw much light on the question of color-blindness in uncivilized men, for we have here not a statement of what these Indians *see* in the way of color, but only of

what their idioms are able to express. Nevertheless, the author's conclusions, which apply only to seven Indian idioms, are interesting; they are as follows: 1. The Indians distinguish as many as, if not more *shades* of color, than we do. 2. No generic term meaning *color* exists, and it seems that such a term is too abstract for their conception. 3. Many of their color-terms, even the most opposite ones, are derived from one and the same radical syllable. For example, in the Kalapúya idiom *blue* is péiánkaf pawé-u, and *yellow* pé-i ántk pawé-u. 4. In the Indian lists we observe some names of mixed colors which impress the eye by being not homogeneous. Such is the Klamath term mä'kmäkli, which is the blue mixed with gray, as seen in wild geese and ducks; and gray in most of the dialects means black mixed in with white, or white with black, as in the fur of the raccoon, gray fox, etc. 5. In naming some colors Indians follow another principle than we do, in qualifying certain natural objects by their color, and then calling them by the same name, even when their color has been altered. This we distinctly observe in käkä'kli, *yellow* and *green* in Klamath, the adjective having been given originally to the color of grass, trees, and other plants. Most frequently *blue* and *green* are rendered by one and the same term. 6. As stated above, Indians often follow principles differing from ours in naming colors. The Klamath language has two terms for green, one when applied to the color of plants (käkä'kli), another when applied to garments and dress (tolalúptchi). So, too, *blue*, when said of beads, is expressed by a different word from the *blue* of flowers or of garments. 7. Reduplication of the word-root is very often met with in color-names, but the cause of this is not always the same. In Klamath and the Sahaptin dialects it is distribution and repetition (as of white hairs on a darker ground in the fur of the raccoon); in Dakota it is the idea of intensity that has produced this synthetic feature.

Draper's Researches on Oxygen in the Sun.—Professor Henry Draper, on the 13th of June, laid before the Royal Astronomical Society of London the evidence by which he claims to have demonstrated the existence of oxygen in the sun. A writer in the London "Times" (presumably Mr. J. Norman Lockyer) acknowledges the force of the evidence adduced by Professor Draper. He says: "We think that most spectroscopists will admit that Professor Draper does not pass beyond the limits of scientific caution in claiming that the coincidence shown in his photographs between the bright lines of oxygen and bright parts of the solar spectrum establishes the probability of the existence of oxygen in the sun. The burden of proof, or rather of disproof, should now fall on those who consider that the coincidence may, after all, be merely accidental. To us it seems that if such evidence as Professor Draper has obtained is rejected, hardly any spectroscopic evidence can suffice to prove the existence of an element in the sun. *We certainly have not stronger evidence in the case of sodium or magnesium*, elements which every physicist regards as present in the sun, than Professor Draper has obtained in the case of oxygen."

Telegraph Operators and Consumption.—Pulmonary consumption appears to be an exceptionally frequent cause of death among telegraphers, and one reason assigned for the fact is the peculiarly strained posture which an operator receiving messages continuously is obliged to assume in order not to lose the characters as they are ticked out to him from the sounder. "The operator in receiving bends his head and shoulder on his left side while listening to the sounder, this position confining his left lung and his heart in an unnatural position; and, being assumed day after day, month after month, eventually brings on the dread disease—consumption." But a writer in the "Journal of the Telegraph" suggests a different cause for the prevalence of consumption among telegraphers, viz., the original physical insufficiency of a large proportion of the young men who enter on this career. He says:

"In choosing an occupation for a young man, after he has received an education, if his health is not good, or if he should be of slight build, the question of his accepting a position requiring bodily labor is ignored entirely, and some field of usefulness

is sought that seems to require the least manual labor. Clerking in a store will not answer; it requires too much standing, and lifting of goods, etc. Clerking of any sort is not favored; he does not care to enter the professions—so called; and, in casting about, telegraphing seems so easy—nothing to do but sit at a table and write a little while; then, to vary the monotony, send a while with the key. This, to the uninitiated, appears very inviting, and the consequence is the young man becomes an applicant for a position in some telegraph-office, with a view of learning the art. This is not invariably the case, of course; but it is sufficiently so to justify the statement that more young men of delicate health seek telegraphing as an occupation than almost any other profession or trade, and the result is manifest in our mortality list."

We may remark that, just as the calling of the telegrapher *seems* to be an unhealthy one, owing to causes extraneous to itself, so newly-settled regions, as our Western Territories, often are credited with exceptional healthiness, to which they are not entitled. Such regions attract vigorous, adventurous young settlers, the very "pick and choice," physically, of the older settlements. Of course, among such a population disease is infrequent and the death-rate is low. It is an egregious fallacy, of course, to attribute this low death-rate to the benignity of the climate of their new home.

Discovery of a Remarkable Cave in Algeria.—The "Courier," of Tlemcen, Algeria, describes an interesting discovery, recently made, at the cascades near that place. Some miners had blasted an enormous rock near the cascades, and, on the removal of the *débris*, found it had covered a large opening into a cave, the floor of which was covered with water. Constructing a rude raft, and providing themselves with candles, the workmen sailed along this underground river, which at a distance of sixty metres was found to merge into a large lake of limpid water. The roof of the cavern was very high and covered with stalactites, the brilliant colors of which sparkled in the light of the candles. Continuing their course, the workmen had at certain places to navigate their craft between the stalactites which, meeting stalagmites from the bed of the lake, formed massive columns which looked as if they had been made expressly to sustain the enormous arches. Thus they reached the extremity of the lake, where they noticed a large channel extending southward. This is supposed to be a large fissure which has baffled exploration hitherto at Sebdon, and which connects the cascades with that locality, and thus with the mysterious sources of the Tafna. It is possible that here they have found an immense natural basin, supplied by powerful sources, and sending a part of its waters toward the lake, while the rest goes to Sebdon. The workmen estimated the distance underground traversed by them at three kilometres, and the breadth of the lake at two. They brought out with them a quantity of fishes, which swarmed round the raft, and which were found to be blind.

The Fodder-Tree.—It is proposed to introduce into India from Jamaica the *Calicandra saman*, a fodder-yielding tree supposed to be a native of the South American mainland. In Jamaica the tree is popularly known as the *guango*. It is a lofty tree, in general habit much resembling the English oak. The trunk is thick, generally short, and branched a few feet from the ground. The primary branch divisions are often tree-like in size, measuring nine to twelve feet in circumference at the base. The lower branches spread horizontally, and the upper are erect, spreading, giving the tree a flattish, dome-shaped appearance. Trees are not unfrequently seventy feet high, the diameter of whose branch expansion horizontally is over thirty feet. The shade which this tree affords is always flecked with gleams of sunshine which flit about as the branches wave with the breeze. This characteristic is coupled with the fact, which is of equal importance to healthy vegetation, that the leaves and leaflets rigidly close together at night, thus permitting the fall of dew on the ground under the branches. Grass grows freely within the overshadowing of its ample arms close up to its trunk. On this account alone it should be planted in pastures wherever it will thrive, as a grateful shade for cattle. But, further, it is itself

a valuable fodder-yielding tree. The fruit when ripe is a bright brown pod six to ten inches long, about an inch wide, and a quarter of an inch thick, the substance of the pod consisting of a sugary, amber-colored pulp. The pods are borne in great profusion. As they ripen they drop to the ground, and are picked up and eaten with much relish by all kinds of stock. The excellent quality of this fruit as a fodder is evident from its fattening effect — stock having access to it improve markedly during the time it is in season. The pods can be stored for use in winter and spring.

Another New Metal (?).—We take from "La Nature" a brief account of a new metal, *norwegium*, lately discovered by Daffi in an arseniuret of nickel, copper, and iron. Unlike most of the new elements latterly discovered, this new metal was *not* discovered by the aid of the spectroscope; indeed, Daffi does not appear to have examined its spectrum. The oxide of norwegium is easily reduced by carbon or by hydrogen; the metal is white, malleable, of the hardness of copper, and is fusible at a low red heat. Its density is equal to 9·44. It dissolves readily in hydrochloric acid; but nitric acid soon forms a nitrate. The concentrated solution is blue; on adding water it becomes green. Its chemical equivalent is 196 if the oxide is a protoxide. It is precipitated by potash, ammonia, and carbonate of soda, and redissolves in an excess of the precipitant. Sulphuretted hydrogen gives an insoluble brown precipitate in the sulpho-hydrate of ammonia. At the blowpipe, with borax, it forms a globule which is green while hot, but when cold, blue. The phosphorus salt yields a yellow globule, which on cooling becomes emerald green.

The Flight and Fall of Meteors.—Professor C. U. Shepard, in a paper on "Meteorites," read before the Connecticut Academy of Sciences, states the number of supposed independent falls of such bodies, whereof specimens are preserved in museums, as about three hundred and fifty, which number is increasing at the rate of between three and four per year. In the northern hemisphere there are two regions where falls of meteorites have been most frequent. "These regions," says Professor Shepard, "are apparently situated where they have been similarly influenced by the earth's magnetic polarity. The regions are on opposite sides of the hemisphere, have similar areas, and are in analogous directions and at similar distances from the two terrestrial north magnetic poles." The author calls attention to the highly magnetic constitution of nearly all meteorites, and to the fact that each mass, whether large or small, of a detonating meteor, maintains during its aërial flight a fixed axial direction. He infers that "if a strong magnetic force is found to attend these bodies, the perplexing subject relating to their high and variant velocities may receive some elucidation." He thinks that the great objection to the theory of the volcanic origin of meteorites, viz., that their velocity is too great, may be obviated by the hypothesis that acceleration may be produced by the electro-magnetism of the earth.

A Natural Well.—In March last a remarkable "sink-hole" was discovered in Meade County, Kansas. In May it was visited by Professor B. F. Mudge, who gives an interesting account of it in the "Kansas City Review of Science and Industry." This sink-hole made its appearance in a grassy prairie at a point forty miles south of Dodge, and its site was formerly crossed by a wagon-road. This road is little frequented, but those who passed over it early in March saw nothing new where now the sink-hole exists. About March 18th the road had disappeared, and in its place was a deep cavity. As seen by Professor Mudge on May 5th, it had the appearance of a gigantic well, sixty feet deep and 610 feet in circumference, being nearly circular. The walls were perpendicular, or nearly so. The material of the soil, at least to the depth of seventeen feet, consisted of a firm clay shale of reddish tinge. All around the cavity were circular cracks parallel to the rim, from five to fifteen feet deep, and from one to ten inches wide. These had opened at the time of the catastrophe, and appear as though ready to cave in; but one of the party that accompanied Professor Mudge had visited the spot a month earlier, and he

could not notice any change as having occurred in the interval. The depth of water at a few feet from the edge was from fifteen to twenty-seven feet; at the center it was forty-two feet: as the surface of the water was seventeen feet below the surface of the ground, the total depth of the cavity was sixty feet. The water is a strong brine, yielding one bushel of salt for forty-three gallons of the water.

Professor Mudge's explanation of the phenomenon is as follows: "The Dakota sandstone crops out in Clark County, twenty miles distant, and dips at a small angle toward this spot, and undoubtedly underlies the whole of Meade County. This sandstone is quite soft in some of its strata, and covered by harder beds. The softer portions are liable to be washed out by subterranean waters, and thus form caverns which are roofed by the hard layers. The cavern in this case became enlarged until the roof was unable to sustain the overlying prairie soil and shale, sixty feet in thickness, and the result is what we now behold. As what was the grass-grown prairie is now the bottom of the cavity, the height of the cavern must have been at least sixty feet, and its floor at least twice that distance (120 feet) below the traveled road. If it is still spread out in smaller chambers, other depressions like the present may occur."

Asphaltum and Amber in New Jersey.—In the neighborhood of Vincenttown, New Jersey, asphaltum and amber have been found, the former in the ash-marl, a layer above the green-sand proper; and the latter in the marl of the Cretaceous formation. Mr. E. Goldsmith, of the Academy of Natural Sciences of Philadelphia, describes the asphaltum as very brittle, black, with a resinous luster. Its fracture is uneven, inclined to conchoidal; the streak and powder brown. It melts easily in the flame, like wax, and burns with a yellow, smoky flame, leaving, after burning, a voluminous coal and but little ashes. The amber (or yellow mineral resin) was found at no great distance from the asphaltum. It occurs frequently in the marl of the Cretaceous formation, but not regularly: sometimes hundreds of tons of the marl may be looked over without finding a single piece of the amber; at other times enough has been found to fill a barrel within a day. According to Mr. Goldsmith, this mineral differs in several particulars from the typical amber found at the bottom or on the coast of the Baltic Sea. The former is lighter than water, the latter heavier. The Baltic amber fuses into a thick, sluggish fluid; the Vincenttown amber into a very fluid mobile liquid. It takes fire easily, and burns with a yellowish, strongly smoking flame, leaving but little coal, which rapidly burns away, and leaves a small quantity of dark-colored ashes.

NOTES.

Sir William Fothergill-Cooke, Wheatstone's associate in the work of introducing in England the electric telegraph, died June 25th, in the seventy-third year of his age.

There lately died in England the Rev. Canon Beadon, of Stoneham, who distinctly remembered some of the events of the Lord George Gordon riots in 1780. He was born in 1777, and succeeded his father in the "living" of Stoneham in 1812. He was fond of shooting and fishing; the former amusement he kept up till ninety-four, the latter till eighty-eight. At ninety-seven he had his first severe illness—an attack of bronchitis, and he was never after quite the same.

In Berlin there is a chemical laboratory, established by a society of housewives, for the examination of articles of food. It is directed by a competent chemist, who gives to the members of the society a course of lectures on practical chemistry. There is also a cookery-school under the patronage of the society. Domestic servants who have remained a certain number of years in one household (of a member of the society) are rewarded with prizes. The society also procures situations for domestic servants.

Among many new and interesting facts developed by Dr. Arthur Haviland in a recent discourse on the distribution of disease, was this, that the mortality of women from cancer is highest in those districts which skirt the banks of rivers subject to periodic floods. Having ascertained this fact, Dr. Haviland studied the physical and geological characters of the districts where cancer does not thrive, and found that all these districts are characterized by being high and dry, with non-retentive soils. The obvious conclusion for all this is, that patients who show tendency to cancer, or persons in

whose families cancer appears to be hereditary, should choose for their permanent residence high, dry sites. During the last twenty years no less than 100,000 women died from cancer in England.

PROFESSOR COHN, of Breslau, has been making experiments with the electric light on the eyes of a number of persons, for the purpose of ascertaining its influence on visual perceptions and color-sensations. He finds that letters, spots, and colors are perceived at a much greater distance through the medium of the electric light than by day or gas light. The sensation of yellow is increased sixty fold compared to daylight, red six fold, blue two fold. Eyes which can only with difficulty distinguish colors by day or gas light, are much aided by the electric light.

A CURIOUS survival of an old-time institution exists in some remote places in England, viz., the official ale-taster. The ale-taster takes an oath to "try, taste, and assize the beer and ale put on sale" in his district "whether the same be wholesome for man's body." The old ale taster's method of "analyzing" beer for the purpose of detecting the addition of sugar to the liquor was rather primitive. Like most men in those times, he wore leather breeches, and, when he went to test the ale for the presence of sugar, a pint of fluid was spilt on a well-cleaned bench, and the taster sat upon it till it dried. If, on rising, the seat of the breeches stuck to the bench, then sugar was present, but if not the beer was pure.

IN the Himalayas, says "Das Ausland," is found a plant of the family *Aroideæ*, which strikingly resembles a cobra with its head erect: it is known as the cobra-plant. The half-moon-shaped markings on the cobra's head, and the lines on its neck, are imitated in the flower-sheath of the plant, while the tongue-like elongation of the pistil and of the midrib of the flower-sheath serve to increase the resemblance of the plant to a living animal. Indeed, so striking is this resemblance, that on coming upon it unawares a person instinctively recoils with horror.

PROFESSOR EMERSON REYNOLDS, of Dublin, has discovered a new explosive, compounded of two substances, which can be kept apart without risk, and can be mixed as required to form a blasting agent. The powder is a mixture of seventy-five parts of chlorate of potassium with twenty-five parts of "sulphurea," a body discovered by Professor Reynolds, which can be obtained cheaply from a waste product of gas manufacture. The new explosive is a white powder, which can be ignited at a lower temperature than gunpowder, and leaves less solid residue.

A FIRST trial has recently been made at Woolwich, England, of a new gun having the following dimensions: Length, 36 feet; diameter at breech, 6 feet 6 inches; diameter at muzzle, 2 feet 4 inches; depth of bore, 33 feet; caliber in powder-chamber, 19¼ inches; caliber at muzzle, 17¼ inches. The gun weighs a hundred tons, carries a shot weighing one ton, and the first time it was fired received a charge of 440 pounds of powder.

A REPORT of the Medical Department of the Russian Army shows that, of the 1,400,000 boys registered as having been born in 1855, there were living in 1876 only 610,000, or 43½ per cent.

A "VERY peculiar, if not unique" case of albinism is recorded in the "Lancet." The subject is a girl of eleven years of age, having pink eyes, with the usual photophobia, but *hair of a bright-red color*.

A NEW process for making artificial stone, invented by Ternikoff, is thus described in "Le Monde de la Science": A mortar consisting of equal parts of lime and sand is exposed for a few hours to a temperature of 150° Centigrade in the presence of water-vapor. The paste having been taken out of the furnace is now passed under the cylinders of a machine like that used for molding bricks, and it comes out in the form of cubes which, on being exposed to the air, become dry and hard. In the course of eight or nine hours these cubes are as hard as good building stones, and are fit for use. This artificial stone is in fact a sort of brick of mortar baked at a low temperature, and the cost, too, is about the same as that of bricks.

IN the Rotorua District, New Zealand, are several hot springs, one of which at least differs essentially from any other thermal spring of which we have any knowledge. This is Tapui Te Koutu, a pool eighty feet deep, with a temperature of 90° to 100° when the wind is westerly or southerly; but, if a change of wind to north or east takes place, the water rises four feet and the temperature to 180°! Turi-Kore is a waterfall with a temperature of 96° to 120°, and is in high repute among the Maoris for the cure of all cutaneous diseases. Kuirau, 136° to 156°, is so soft that clothes can be washed in it without soap. Koroteoteo, a boiling spring, 214°, is known as the "Oil-bath." Kauwharga, a powerful sulphur-bath, bears the name of the "Painkiller." Ti Kute, the Great Spring, three-quarters of an acre in extent, boiling furiously and always throwing off great clouds of steam, is reported to be "wonderfully efficacious in cases of rheumatism and cutaneous diseases."

EDWARD FRANKLAND.